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HANDBOOK No. 23

Some Common Marine Fishes of British Columbia

By G. CLIFFORD CARL
Illustrations by Frank L. Beebe

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By G. CLIFFORD CARL
Illustrations by Frank L. Beebe

VICTORIA, B.C. JULY, 1964

PREFACE

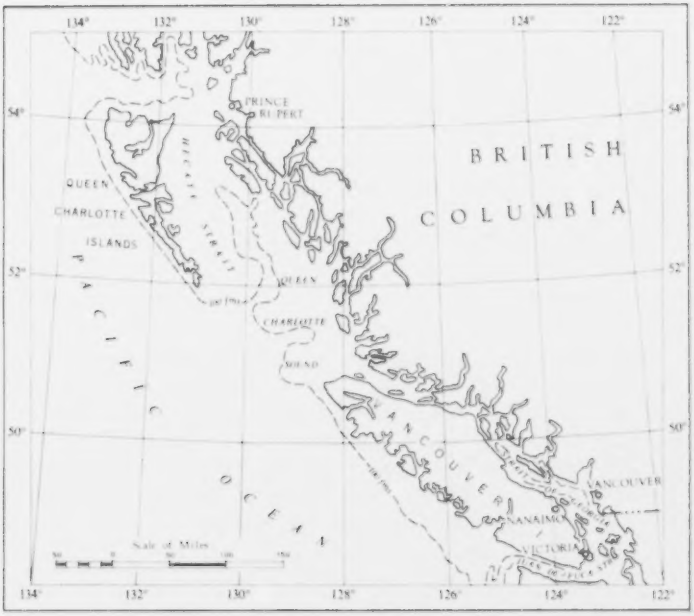
Since 1946 when " Fishes of the Pacific Coast of Canada," by W. A. Clemens and G. V. Wilby, first appeared (to be followed by a second edition in 1961), an excellent reference book to the marine fishes of British Columbia has been available. Nevertheless, there still seems to be a need for a less detailed account of the common species for the use of those persons who do not wish to acquire the complete work. The present booklet is the result of our attempt to provide an inexpensive guide to those fishes most likely to be seen by the average person.

With the very kind permission of the two authors noted above, I have drawn heavily on their work for material in the present publication. In some cases direct quotations are used, with the source acknowledged; in other instances I have shamelessly utilized their information without giving specific credit. At this point I hasten to acknowledge my indebtedness to the late Dr. Clemens and to Mr. Wilby for this rather special privilege.

The greater number of the illustrations, too, are copied direct from the above-mentioned publication, with permission from the editor, Dr. J. C. Stevenson, of the Fisheries Research Board of Canada. To him I am grateful for this particular courtesy.

I am thankful also to all those fishermen, skindivers, and other friends who have contributed bits of information for use in this publication.

G. C. C.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Some Common Marine Fishes of British Columbia

INTRODUCTION

Fishes form only a part of the life in the sea, but to us they are important because they provide us with food and with sport. Other values of a non-economic nature can also be placed on fishes, depending upon our interests in this group of living creatures. Their almost limitless variation in body form, their bright colours, active movement, and interesting breeding habits all combine to fascinate whether they be viewed by a skindiver in their native element or by a visitor to an aquarium. Indeed, interest is probably increasing in this aspect of marine life with increased leisure time, with improvements in underwater equipment, and with the construction of more public aquariums.

To appreciate fishes better as living creatures, it is necessary to know something of the world they live in, particularly their relationship with other forms of marine life, both plant and animal. Only by understanding some of the physical and chemical conditions that exist in the water and the interdependence of all living things can a true picture be formed of the fishes.

The sea occupies such a vast part of the world, being more than double the continents in area, that it has always been a source of wonder. However, great strides have been made in recent years in gaining knowledge of this relatively unknown portion of the earth's surface so that we can now say that much of the mystery has been removed.

A great deal of information has been gathered in the last few decades, mostly as a result of the impetus provided by the Second World War and aided greatly by improved scientific equipment and by the rapid spread of skindiving.

Nevertheless, much remains to be uncovered, mainly information concerning the life-history of the bewildering array of plants

and animals that inhabit the sea, the details of the intricate relationships that exist between them, and finally how the resources of the sea can best be used for the benefit of man.

THE FISH'S ASSOCIATES

Until quite recently a number of queer notions existed concerning sea creatures in general; some still persist of course, but many have been dispelled by modern research. For example, it was once thought that all living things were confined to the upper couple of hundred feet of water because below that depth where daylight could not penetrate, no plants existed and therefore no animals could live because of the lack of food or because of the tremendous pressure. Now we know that despite the lack of plant life in depths greater than about 200 feet and despite the pressure, many kinds of animals live in these cold and dark waters. In fact, living organisms have been found in the greatest depths yet explored, and there are good reasons to believe that the deepest parts of the oceans will be found to be inhabited by animals of some kind. It is difficult to realize the abundance of life in salt water. In numbers of individuals alone, far more plants and animals live in the sea than on dry land. Most of this marine population consists of the smaller forms of life, organisms which float freely in the water and in such numbers that they colour the ocean for hundreds of square miles. This drifting life, called "plankton," is abundant beyond measure and forms the basic food source for most of the larger animals.

The larger creatures, though they are greatly outnumbered by the planktonic forms, are the conspicuous members of the marine world, consequently they are the ones better known by the layman. Nevertheless, they occur in such a variety of forms that to classify them all completely is a task not yet accomplished despite the numbers of biologists working in this field, and even to name the common species, is sometimes most difficult. Every natural group of animals, from the protozoa to the mammals, has representatives in the sea, and many of the species of the simplest plant division, the algæ, are found in the form of seaweeds.

Of this great assemblage of living things, the fishes are only a small but nevertheless important part. Each species plays a role in the economy of the sea; and to man, salmon, halibut, cod, herring, and other food fishes are of great value.

Let us consider fishes and other marine life in four general groups according to habitat. First, there are those forms which frequent the shallow waters along the coastline. These include the many kinds of sculpins, some of the flatfishes, the seaperches, rockfishes, quillbacks, and such common sea-shore animals as the starfishes, barnacles, mussels, shore crabs, and a host of other creatures found associated with rocks, boulders, mud, sand, and piles or floating wharves. Here, too, are veritable forests of seaweeds, ranging from delicate feather-like fronds gracing a tidepool to massive beds of kelp securely anchored in deep water along the rocky shore. The intertidal area and the relatively shallow water bordering the land are probably the most productive parts of the ocean. Here an abundance of light and plenty of footholds and retreats, together with ample food materials carried in by favourable currents, all combine to form optimum conditions for growth and reproduction.

Next there are the unattached organisms, the plankton already referred to, those small plants and animals floating free in the water, some capable of swimming feebly but all at the mercy of currents, which may carry them great distances. Included here are innumerable plant forms, mostly microscopic in size, but in such vast numbers they are the staple diet of hordes of plant-eaters which spend their lives straining this vegetable soup through their food-gathering organs. Here also are great armies of crustacea called copepods, plus swarms of other shrimp-like forms and astronomical numbers of larval stages of animals such as crabs, worms, starfishes, molluscs, and fishes, not to mention un-countable millions of translucent eggs released by many kinds of animals, including fishes such as pilchard, anchovy, halibut, sablefish, cod, lemon sole, and ocean sunfish. So abundant are these relatively minute specks of life making up the plankton that they cloud the ocean, colour the water red, pink, brown, or yellow, and restrict vision to a few feet. Yet they are most important because they provide food for worms,

molluscs, crabs, fishes, some birds, one kind of seal, some of the whales, and other kinds of animals.

The third group is the fishes and other animals that roam the open water. Here are the schooling forms, such as the herring, pilchard, anchovy, eulachon, and sandlance, and their predators, dogfish, other sharks, salmon, albacore, and possibly the cod. Among the invertebrates, perhaps the squid is the most important animal in this relatively open-water environment. Even in the deep parts where daylight can never penetrate, there lives a population of fishes highly specialized for existence in perpetual darkness. All are carnivorous, and many have luminescent organs which enable them to capture prey or to find mates.

Finally there are those creatures which live on the bottom in the greatest depths at temperatures near freezing and under tremendous pressure. A surprising number of animals have been found in these deep parts, where scientists formerly thought nothing could live, mostly serpent stars, worms, and even a few types of fishes. For food they must depend upon the rain of organic matter which slowly settles from the inhabited strata nearer the surface.

How is it that the ocean supports such a vast number of living things and in such a variety of form? Briefly, we can say that sea water provides conditions that are admirably suited for living creatures. The temperature is relatively uniform, and the basic materials, such as oxygen and growth-promoting chemicals, are immediately available in almost unlimited quantities. There is also the time factor to consider. Because the oceans are the oldest part of the world, they have provided a suitable environment for life for a much longer time than have the land masses. Their antiquity is reflected in the extent and diversity of their fauna.

IDENTIFICATION

The first question that comes to a person's mind on seeing a fish is " What is it? " but to find a satisfactory answer is not always easy. Even experienced fishermen may be puzzled by some of their catch, especially if the fish in question is a " little out of the ordinary." Part of the difficulty is due to the fact that many similar-looking fishes are easily confused, and technical literature concerning local

fishes is usually not immediately available. Moreover, the lack of universally accepted common names also adds to the confusion.

This booklet has been designed to help provide the answer to the the question of identity as well as to provide general information of interest. However, its scope is necessarily limited. As it is obviously impractical (and unnecessary) to include the more than 270 species know to occur in British Columbia waters, this booklet is restricted to a relatively few fishes. Those selected for inclusion have been chosen because they are common and therefore most likely to be seen by the average person who visits the sea beach or spends some time on coastal waters. For information on the less common fishes and for more technical details on all species, the reader is referred to " Fishes of the Pacific Coast of Canada," by Clemens and Wilby.

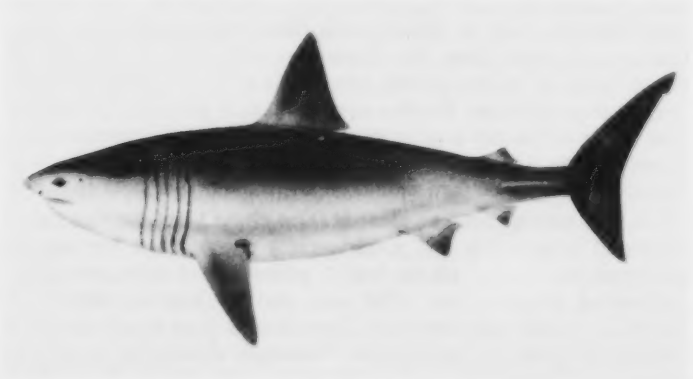
No keys are given because these are available in some of the more detailed publications listed under " References " and because most laymen seem to avoid using these word guides to identification. In most cases the illustration will serve to identify the fish in hand, or at least it will give a clue as to the group to which the specimen belongs. Further confirmation is given by the description, which ordinarily is sufficient to make the identification positive. If uncertainty still remains, the more detailed references should be consulted or the specimen should be turned over to a local authority.

A fish which requires identification should not be cleaned or mutilated in any way. If a refrigerator is available, freezing the specimen in a sealed plastic bag is probably the most convenient method of preservation. Fish can also be kept indefinitely in formalin (1 part of commercial formalin to 9 parts of water) or alcohol (4 parts of commercial isopropyl alcohol to 6 parts of water). If liquid preservative is used, a slit should be made in the belly to allow the fluid to enter the body cavity, and in all cases a label should be attached giving date and place of capture as well as the collector's name.

The common names used for fishes have always been a source of confusion because such names vary from place to place and some imply relationships which do not exist (for example, " rock cod " for a fish that is unrelated to cods). To help standardize

usage, an international committee of fishery biologists has been working on common names for a number of years. The members of the committee may agree upon the universal use of a certain name, but it does not always follow that their recommendation is widely accepted. Thus in many parts of coastal British Columbia "spring salmon" is still used in preference to "chinook salmon," and "pilchard" is preferred to "Pacific sardine."

In this booklet the common names used in the majority of cases are those recommended by the committee, but some are not. In any case the scientific or technical name is also given for each fish so that no uncertainty can exist. To make the technical names more understandable and meaningful, they have been "translated" into an English equivalent or their derivation has been indicated in each case.



Basking Shark ***Cetorhinus maximus* (Gunner)**

Ceto/rhinus = whale shark.
maximus = greatest.

Description.—A very large shark with a large triangular dorsal fin and prominent tail fin, both of which may project above the water as the animal lies or swims at the surface. A small spiracle behind the eye. Five long gill slits on each side, extending almost

to the mid-line on the undersurface. Gill rakers long, slender, and horny. A prominent keel on each side of the base of the tail.

Colour: Bluish-grey to brownish-grey, paler on the under surface.

Size: Up to 45 feet in length, average size from 20 to 30 feet.

Range: Temperate seas of both hemispheres; along the Pacific coast from Gulf of Alaska to southern California.

Quick Check.—A large shark with the first dorsal fin large and triangular in shape and with long gill slits.

Notes.—The basking shark is noteworthy mainly because of its size; it is the second largest fish in the world, being exceeded only by the whale shark of tropical waters, which attains a length of at least 50 feet.

As in all sharks, the skeleton is of cartilage. Occasionally a partial skeleton is found on a beach, when it may give rise to a report of a sea serpent because of its great length and serpentine appearance.

The basking shark feeds upon small organisms, which it strains from the water as it swims. It is entirely harmless, but it is unwise to approach too closely in a small boat since the fish may accidentally swamp the vessel or damage it in its efforts to sound quickly.

Although basking sharks are not fish-eaters, they are occasionally an expensive nuisance to fishermen because they blunder into nets, causing considerable damage to gear and resulting in loss of time. They have little value; the flesh is not acceptable as food, and it is uneconomic to utilize them for the manufacture of fish meal. The liver, however, is extremely large and may yield from 80 to 200 gallons of oil. A production of 400 gallons is recorded from one liver (Norman and Fraser, 1949).

Apparently Indians used to use this fish, judging by the following extract (Swan 1870):—

"A very large species of shark, known among whale men as 'bone shark,' is occasionally killed by the Makahs, and its liver yields great quantities of oil. I saw one in October, 1862, killed in Neah Bay, twenty-six feet long, and its liver yielded nearly seven barrels of oil, or over two hundred gallons. These sharks are

very abundant during the summer and fall, but the Indians rarely attack them except when they come in shore to feed, which they do at certain times. They are easily seen by the long dorsal fin projecting above the water, and, as they appear to be quite sluggish in their movements, are readily killed with harpoons or lances. The flesh is never eaten."

Besides the basking shark and dogfish, the following are known to occur in British Columbia: Sevengill shark (8 feet); sixgill shark (26 feet); salmon shark (10 feet); thresher shark (25 feet); brown cat shark (2 feet); soupfin shark (6 feet); blue shark (25 feet); sleeper shark (25 feet); white shark (40 feet).

Of these, the salmon shark is probably our most voracious species; it is sometimes called " man-eater " by fishermen, although there are no authentic records of it attacking human beings. The true man-eater, the white shark, has been reported only once in British Columbia (Pike, 1962).

Dogfish ***Squalus suckleyi* (Girard)**

Squalus = shark.
suckleyi = named after Dr. George Suckley, naturalist on the U.S. Pacific R.R. Survey.

Description.—Shark-like in general appearance with a cigar-shaped body and the upper lobe of the tail fin larger than the lower. Two dorsal fins, each preceded by a spine. No anal fin. Skin

rough because of the presence of minute spiny scales. A prominent spiracle behind the eye. Five gill slits on each side behind the head.

Colour: Grey or dark brown on the back, whitish on the undersurface. Light spots are present on the back in the young.

Size: Up to 5 feet 3 inches in length. The males are usually smaller than females.

Range: North-western Alaska to southern California, mainly along the coast.

Quick Check.—A small shark with two dorsal fins, each preceded by a sharp spine.

Notes.—To most anglers the dogfish is a nuisance and a pest. It takes lures readily, particularly herring strip and other fresh bait and is often difficult to remove from the hook without major surgery. The sharp teeth and abrasive skin tend to cut or damage leaders so that lures are often lost as a result of dogfish attention. Trolling at a faster speed lessens the chance of picking up these pests but is not a sure cure.

At one time during World War II, dogfish were taken commercially in large numbers for their livers, which were used as a source of Vitamin A. Fishing was so intensive they became quite scarce, and remained so for some years after the market for livers slumped.

More recently the Federal Government paid a subsidy of 12 cents a pound for liver in order to increase the take of this fish. In 1961, $150,000 was allotted to this project, and all but a few thousand dollars was claimed by fishermen.

Another relatively minor type of control is the annual dogfish derby sponsored by some fish and game clubs, on which occasion several hundred fish may be destroyed.

The possibility of using dogfish as food has also been suggested a number of times, but no serious attempt has been made to place the fish on the market. In actuality the flesh is good to eat providing the fish is fresh and properly cooked. Advocates advise skinning the fish and removing the flesh as a fillet from each side. It may be either boiled or fried.

Both the oil from the livers and the flesh were eaten by Indians on the west coast of Vancouver Island and Cape Flattery, as indicated by the following account (Swan, 1870):—

"The method of extracting as practised by the Makahs is to collect the livers, which are put into a tub and kept until a considerable quantity has accumulated. They are then put into iron pots, and set to simmer near the fire; or else hot stones are placed among them and they are cooked by the heat until all the oil is extracted which is then carefully skimmed off and stored in receptacles, made of the paunches and intestines of whales, fish, or seals. In the fall of the year the flesh of the dogfish contains a considerable proportion of oil, which at other times it does not appear to possess; this is extracted in the following manner: When the livers are taken out, the head and back bone are also removed, the rest of the body being first slightly dried in the smoke, is steamed on hot stones till it is thoroughly cooked. It is then put into little baskets, made for the purpose, of soft cedar bark, and rolled and squeezed till all the liquid is extracted. This in colour resembles dirty milk. It is boiled and allowed to cool and settle, and the oil is then skimmed off. After the oil is extracted, the flesh is washed in fresh water and again squeezed in the baskets, and in this state it is eaten by the Indians when other food is scarce. But dogfish is seldom tasted by the Makahs, and never until the oil has been thoroughly removed. The oil has a nauseous taste, and is not relished by these Indians, who are epicures in their way, and prefer the oil of whales and seals. The quality of dogfish oil for burning is very good, quite superior to whale oil. In astral lamps it burns with a clear, strong flame, and, when properly refined, is second only to sperm oil. Dr. Suckley states that while he was on service as surgeon at the U.S. military station at Fort Steilacoom, he used dogfish oil with great success in pulmonary affections, and considered it, when fresh, equal to cod-liver oil."

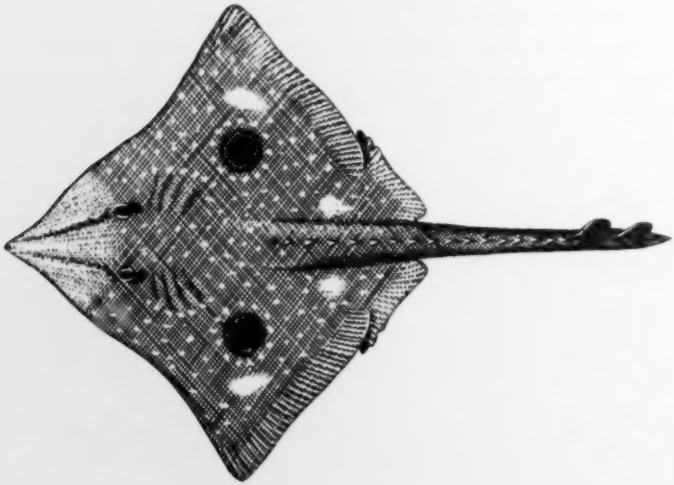
Dogfish feed upon herring, sandlance, smelts, and other small schooling fishes, as well as squid and crustaceans. They also act as scavengers, and therefore are attracted to canneries and fish wharves and are readily taken on set-lines. Skindivers report seeing numbers of dogfish resting on the bottom in 40 to 60 feet

of water. In the evening the fish move into shallower water and, on one occasion, they were seen "herding" a large number of squid.

The young, 3 to 14 in number, are born alive after a gestation period of about 18 months. Growth is slow, and some individuals are believed to reach an age of 30 years.

Dogfish often move in large schools in offshore waters and may travel great distances. One individual, tagged off the east coast of the Queen Charlotte Islands in September, 1945, was captured off Santa Cruz, California, six months later.

Another name for this small shark is grayfish.



Big Skate

***Raja binoculata* Girard**

Raja = ray or skate.
bin/oculata = two eyes, referring to eye-spots.

Description.—A large, flattened fish with a long slender tail. Snout pointed; a prominent spiracle behind each eye. Five gill

slits on the ventral surface. A series of large spines along the mid-line of the back and tail. Outline of pelvic fins concave when extended.

Colour: Brownish, grey, or nearly black on the upper surface. A prominent black eye-spot on each side, each within a dark ring (the light ring in each eye-spot is reddish in young fish). Many white spots scattered over the body. Almost dead white on the undersurface.

Size: Length to 8 feet. Individuals in excess of 9 feet from tip to tip across the back have been reported.

Range: Alaska to southern California.

Quick Check.—A large skate with prominent eye-spots, concave pelvic fin outline, and white underside.

Notes.—The big skate is the largest of our skates. It is found all along the coast at depths varying from shallow to moderate. Occasionally individuals are seen in water only a few feet deep, especially over mud flats on an incoming tide. Divers report that skates are common on sandy bottom.

Egg case of skate.

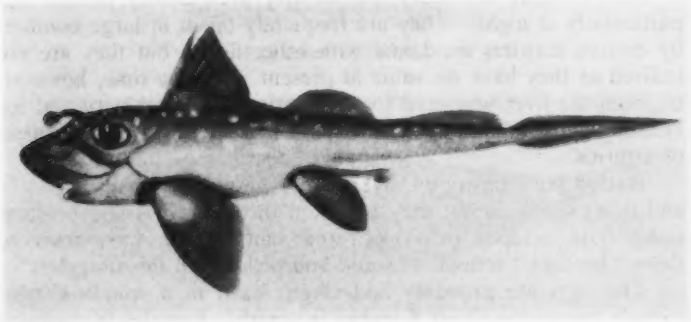
Food consists mostly of crustaceans and fishes; two sculpins, each about a foot long, were found in one stomach.

As in all skates, water is drawn into the breathing-chamber through the spiracles on top of the head and is expelled through the gill slits on the underside.

Two to seven eggs are laid at any season in a parchment-like case ranging in length up to 12 inches; they may require a year to hatch. The egg case is sometimes called a " mermaid's purse " when found cast up on the beach.

Skates are taken by trap, trawl, and set-line; the " wings " are sold on the fresh market as food.

In addition to the big skate, the longnose skate (*Raja rhina*), the starry skate (*Raja stellata*), the black skate (*Raja kincaidii*), and the deepsea skate (*Raja abyssicola*) occur in British Columbia.



Ratfish ***Hydrolagus colliei*** **(Lay and Bennett)**

Hydro/lagus=water-hare (referring to rabbit-like teeth).
colliei=a personal name.

Description.—A grotesque-looking fish with a large head and a body tapering to a pointed tail. The rounded snout overhangs a small mouth with prominent rodent-like teeth, 4 on the upper jaw, 2 on the lower. The eye is large. The first dorsal fin has a sharp, strong spine with fine teeth on the posterior edge; the second dorsal is divided into two parts. The pectoral and pelvic fins are

paddle-like. The skin is smooth, with no scales. In the male a club-shaped structure is carried in a depression on the head, and a long clasper is present behind each pelvic fin.

Colour: Mostly silver or light yellowish-brown with iridescent bronze shadings and round whitish spots on the back and sides. The eye is sometimes emerald green.

Size: Reported up to 3 feet 2 inches in length but most average about 20 inches.

Range: Alaska to southern California.

Quick Check.—A large-headed silvery fish tapering to a pointed tail. The rodent-like teeth are distinctive.

Notes.—Though not commonly seen by the average sport fisherman, ratfish are abundant along the whole coast, usually in water over 40 fathoms in depth. Skindivers report them to be common in shallow water (25 feet), particularly over muddy bottom and particularly at night. They are frequently taken in large numbers by bottom trawlers incidental with other fishes, but they are not utilized as they have no value at present. At one time, however, oil from the liver was used for lubricating fine machinery and for cleaning guns. Some fishermen claim it is useful in the treatment of arthritis.

Ratfish feed mostly on invertebrates, especially crabs, mussels, and other shellfish, but may be taken on hand-lines and set-lines using squid, octopus, or bits of fish as bait. Divers have observed them " herding " schools of squid and picking up the stragglers.

The eggs are probably laid singly, each in a spindle-shaped capsule measuring about 5 inches in length. Females in captivity have been seen to produce capsules in pairs, and each pair was carried partially extruded for several days. Egg cases have been found projecting from the mud in the intertidal zone, but most are probably deposited in deeper water. Recently hatched young have been taken in shrimp trawls in late October and November and also in late April.

A recent study has shown that the dorsal spine is sheathed in tissue, some of which secretes a poison which may be harmful to man. The reproductive organs are also poisonous and consequently should not be eaten.

Lone ratfish are sometimes seen in shallow water around wharves, especially at night, and occasionally sick or injured fish are found stranded on a beach. Such individuals usually are objects of interest to the observer who has never seen such a fish before, especially if it is a male, as such a specimen seems to be equipped with hind legs!

Egg cases of ratfish.

Herring ***Clupea pallasii* Valenciennes**

Clupea = herring.
pallasii = after P. S. Pallas, naturalist and explorer from St. Petersburg.

Description.—A silvery trout-like fish with large scales and a forked tail. No striations on the gill cover and no spots on the side (as in the closely related pilchard). Mouth capable of being extended to form a tube.

Colour: Bluish-green or blue on back, bright iridescent silver on the sides and belly.

Size: Length to 13 inches; 10 to 12 inches is about the average for Georgia Strait and Gulf Islands.

Range: Alaska (Kodiak Island) to southern California.

Quick Check.—Silvery colour and scales which are easily shed.

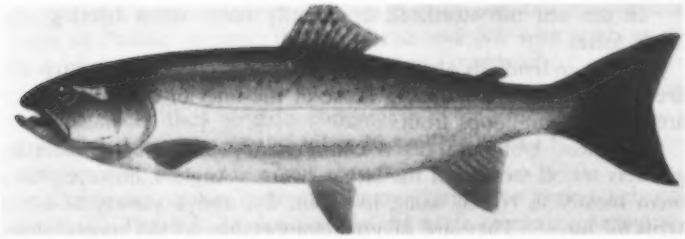
Notes.—The herring is one of our most abundant fishes; as many as 192,000 tons have been taken along the British Columbia coast by commercial fishermen in one season. Most of the catch is reduced to oil and meal; a small part is smoked, canned, or sold as fresh fish. Another increasing use is as bait for sport fishing.

While herring are found along the entire coast, they tend to form local populations that mingle only slightly where they overlap. The fish travel in schools that may consist of many millions of individuals. Schools are located by echo sounders, which also show their position with respect to the ocean bottom. The fish are captured by purse seines, and a single catch may consist of 12,000,000 fish. Herring may be recognized by their peculiar habit of "flashing"; at intervals individuals in the school turn momentarily on their side, with the result that a silvery flash catches the eye now from one part of the school, now from another.

Herring may reach spawning age in their third or fourth year but may live considerably longer, even beyond their eighth year. Spawning occurs in late winter and early spring. Most eggs are laid in the intertidal zone but sometimes in water 30 feet deep. Being adhesive, the roe sticks to seaweeds, rocks, piles, and other support but may be so abundant that windrows are tossed up on the beach. Indians used to gather quantities of eggs by placing hemlock boughs among the spawning fish; eggs so collected were dried for winter use.

The herring is probably the most widely used source of protein food in the coastal waters. The eggs are consumed by birds, fishes, crabs, and even humans; the fish, no matter what size, are eaten by many kinds of sea birds, fishes and squids, seals, porpoises and other marine mammals, and are exploited by man. Some species, such as the spring salmon and the Davidson whale, may feed almost exclusively upon them when they are abundant.

In value, herring are second only to salmon; the annual catch in British Columbia is sometimes worth $10,000,000.



Steelhead

***Salmo gairdnerii* Richardson**

Salmo=Latin name for salmon of the Atlantic.

gairdnerii=after Dr. Meredith Gairdner, a naturalist in the employ of the Hudson's Bay Company.

Description.—Body typically trout-like, with stout peduncle. Head short (about 5 times in total length). Jaw short, scarcely reaching vertical through posterior margin of eye. No teeth on back of tongue. Rays in anal fin, 8 to 12. Scales in first row above lateral line, 130 to 135 (115 to 161 oblique rows).

Colour: Greenish or metallic blue on back, shading to silvery on sides. Dark spots on back, and on dorsal and tail fins. A pinkish band along each side, particularly in males as they near maturity.

Size: Up to 45 inches in length and 36 pounds in weight. Most fish average about 12 pounds.

Range: South-eastern Alaska to California.

Quick Check.—Anal rays, fewer than 13, separate the steelhead from all Pacific salmon; the short head and jaw together with absence of teeth on the back of the tongue distinguish it from the cutthroat.

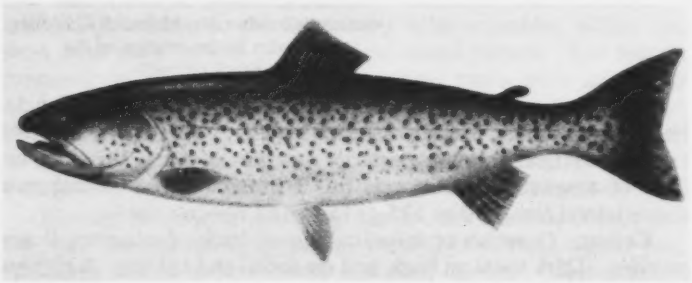
Notes.—Steelhead spend part of their life in the sea and part in fresh water. Egg-laying usually occurs in late winter or early spring in gravel areas of rivers, and after spawning the fish drop back to salt water. About 6 per cent of them return to spawn a second time.

Most of the young remain in fresh water for two or three years before migrating to sea, and they return as spawning adults after two or three years in salt water.

In the sea the steelhead apparently feeds upon herring and other fishes.

Those individuals that remain in fresh water their entire life are known as rainbow trout; those of the interior of the Province are called " Kamloops trout."

Steelhead trout are taken commercially in some numbers by gill-nets set off mouths of the larger rivers. Anglers, however, take them mostly in rivers, using live bait, fly, and a variety of other artificial lures. They are of great importance to the sport fishery of the Province.



Cutthroat Trout ***Salmo clarkii* Richardson**

clarkii = after Capt. Wm. Clark of the Lewis and Clark expedition.

Description.—Body typically trout-like, with stout peduncle. Head long (about 4½ in total length). Jaw long, extending well behind vertical through posterior margin of eye. Teeth on back of tongue. Rays in anal fin, 8 to 12 (usually 10). Scales in first row above lateral line, 143 to 180 (usually 150 to 158 or 170 to 200 oblique rows).

Colour: Greenish-blue on the back, silvery on the sides. Many heavy black dots on back, sides, and fins (except the pectorals and ventrals). A red streak is usually present in the crease below the lower jaw on each side (hence the common name).

Size: Up to 30 inches in length.

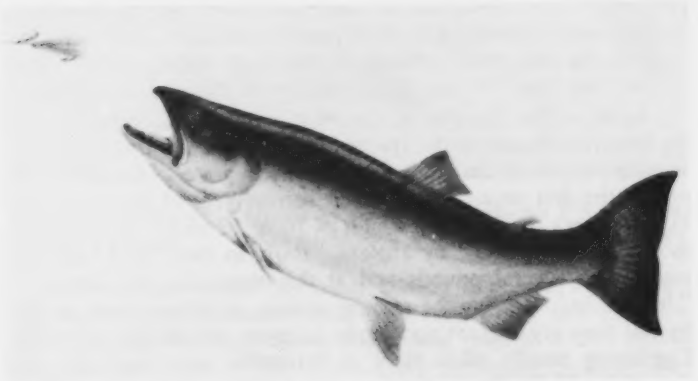
Range: South-eastern Alaska to northern California.

Quick Check.—Anal rays, fewer than 13, separate the cutthroat from all Pacific salmon; the long head and jaw with teeth on the back of the tongue distinguish it from the steelhead.

Notes.—Sea-run cutthroat trout may be taken anywhere along the coast, but they tend to congregate at or near the mouths of streams. Here they may be taken by trolling or casting from shore, using spoons, flies, or live bait.

Cutthroats spawn in small streams during the period February to May. The fish do not usually die after spawning; they may go back to the sea and return the following year to spawn or they may skip a year. The young remain in fresh water for varying periods; some enter the sea when quite small; others apparently remain indefinitely in lakes and streams.

In salt water, cutthroat trout are almost entirely fish-eaters, although insects, crustaceans, and other invertebrates are also taken.



Coho Salmon
Silver Salmon

Oncorhynchus kisutch **(Walbaum)**
Onco/rhynchus = hooked nose.
kisutch = the vernacular name.

Description.—A typical "salmon-like" fish with the sides of the body somewhat flattened and with a stout peduncle. The head is conical in shape, but as the fish nears spawning the snout becomes

hooked, particularly in the male. Gill rakers on the first arch, 19 to 25. Rays in the anal fin, 13 to 16. Scales in first row above lateral line, 120 to 145. Pyloric cæca (finger-like processes on the intestine behind the stomach), 45 to 83.

Colour: Bluish-green on back, shading to silver and then white on the belly. Usually many irregular black spots on back and on the upper half of the tail fin. As the fish approaches spawning time, it becomes much darker, particularly on the head, and the sides become reddish.

Size: Length up to 36 inches and weight up to 31½ pounds (world's record on sport tackle, Mrs. Lee Halberg, of Victoria, in 1947). Heavier fish have been reported but none has been authenticated. Average size is about 30 inches and 6 to 12 pounds.

Range: North-western Alaska to northern California and south on the Asiatic coast to Japan.

Quick Check.—A coho may sometimes be recognized by the presence of black spots on the back and upper half of the tail fin, the gill rakers numbering 19 to 25, and by the short, stout peduncle. Usually the only sure check is to count the pyloric cæca, which number less than 90 (*see* spring salmon for table of comparison).

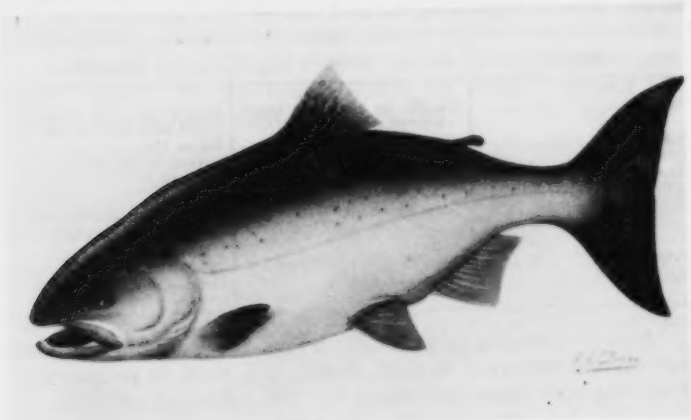
Notes.—The life-span of the coho salmon is three years. The fry hatch in streams in the spring. They remain in fresh water for varying periods of time, but the majority migrate to sea before the end of the first year. During their second year of life (their first in salt water) they attain a length of 10 or 12 inches and are commonly called "grilse" by anglers. Early in their third year they may weigh several pounds and at this stage they are known as "bluebacks." During the ensuing season, growth is rapid, so that by fall they are mature and ready to enter streams for spawning. Egg-laying usually takes place in November and December, and the adults all die after spawning.

Cohoes are primarily fish-eaters, feeding mainly on sandlance and herring; squids, euphausids, and other invertebrates are also taken.

Great numbers of coho are taken by commercial fishermen using trolling-gear, purse-seine, and gill-net. Coho salmon rank second to sockeye in importance in the commercial fishery.

The coho is probably the most popular salt-water fish in British Columbia. It provides fishing almost every month of the year and may be taken almost anywhere along the coast.

The coho takes many types of lure, including spoon, plug, whole fresh herring, herring strip, and other kinds of bait. At times it readily takes a bucktail fly trailed in the wake of a power-boat, and this is one of the most popular ways of angling for this fish.



Chinook Salmon
Spring Salmon

***Oncorhynchus tshawytscha* (Walbaum)**
tshawytscha = the vernacular name in Kamchatka.

Description.—Much like other salmon in general appearance. Gill rakers on the first arch, 18 to 30. Rays in the anal fin, 13 to 19. Scales in first row above lateral line, 140 to 153. Pyloric cæca, 140 to 185.

Colour: Greenish-blue to black on back, shading to silver then white on the belly. Many irregular black spots are usually present on back, dorsal fin, and on both lobes of the tail fin. The whole fish becomes darker as it approaches maturity.

Size: Length up to 4 feet 10 inches and weight over 80 pounds (a chinook salmon 126 pounds in weight was taken at Petersburg, Alaska (International Fisherman, January, 1949, p. 19), and the

world's record on sport tackle is a fish weighing 83½ pounds taken at Rivers Inlet by Frank Piscatelli, of Vancouver, B.C.). Average size about 36 inches and 10 to 50 pounds.

Range: North-western Alaska to southern California and south on the Asiatic coast to northern China.

Quick Check.—The only species with which the chinook or spring might be confused is the coho. The following features should serve in separating the two fish:—

Feature	Coho	Chinook
Spotting	Usually on back and upper lobe of tail fin.	Usually on back, dorsal fin, and both lobes of tail fin.
Scale rows	120 to 145.	140 to 153.
Teeth	Needle-like, firmly set.	Conical, loosely set.
Anal fin rays	13 to 16.	13 to 19.
Gill rakers on first arch	19 to 25.	18 to 30.
Caudal peduncle	Short and stout.	Longer and usually with a definite "shoulder" near the tail.
Pyloric cæca	45 to 83.	140 to 185.
Odour	No musky odour.	Definite musky odour.

Notes.—Chinook salmon vary in their life-span; an individual may become mature in its third, fourth, fifth, sixth, or seventh year, depending upon many circumstances. The larger fish are not necessarily the older, since size depends upon food supply, water temperature, and heredity, in addition to long life.

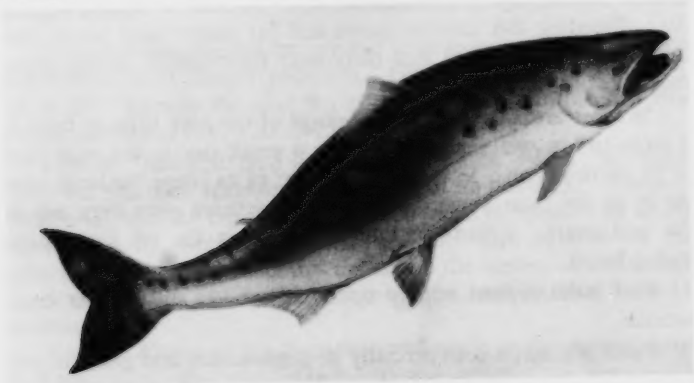
The eggs are usually laid in fairly large rivers or large tributaries, and the fry hatch in late winter or early spring. They migrate to salt water soon after emerging from the gravel or remain in fresh water for times varying up to 15 months. The major growth occurs at sea, perhaps many hundreds of miles from the parent stream. Some males become sexually mature in their second or third years while still quite small; these are commonly called "jacks" or "jack-springs." A few mature fish may enter the larger rivers in late spring or early summer (hence the name "spring salmon"), but the majority commence the spawning run in the fall. As with other Pacific salmon, all die after spawning.

Chinook salmon feed mainly on herring, sandlance, and squid; other small fishes and some crustaceans are also taken in small quantities.

Commercial fishermen take large numbers of chinook by troll, purse-seine, and gill-net. Part of the catch is sold as fresh fish, but the major portion is canned, frozen, smoked, or dry-salted.

Chinook salmon are also an important sport fish. While they may be taken almost anywhere along the coast, favourite spots where large individuals are caught include Campbell River, Phillips Arm, Comox Bay, Gold River, Rivers Inlet, and Alberni Canal. Most popular lures are spoons, plugs, or herring strip activated by a "dodger."

A chinook salmon larger than 30 pounds in weight is sometimes called "tyee." In the United States the name "quinnat" or "king" is sometimes used for this species.



Pink Salmon
Humpback

***Oncorhynchus gorbuscha* (Walbaum)**
gorbuscha = the Russian vernacular name.

Description.—Similar in general appearance to other salmon. Gill rakers on the first arch, 26 to 34. Rays in the anal fin, 13 to 17. Scales in the first row above the lateral line, 170 to 229.

Colour: Metallic blue on the back, silvery on the sides, and white on the belly. Large black blotches are usually present on the back and on the tail fin. Mature males become red on the sides and blotched with brown; the back is prominently humped

(hence the common name "humpback"). Spawning females are olive-green with dusky stripes.

Size: Length up to 30 inches and weight from 3 to 10 pounds. The average weight is probably less than 5 pounds.

Range: Pacific Coast, Alaska to California; northern Japan.

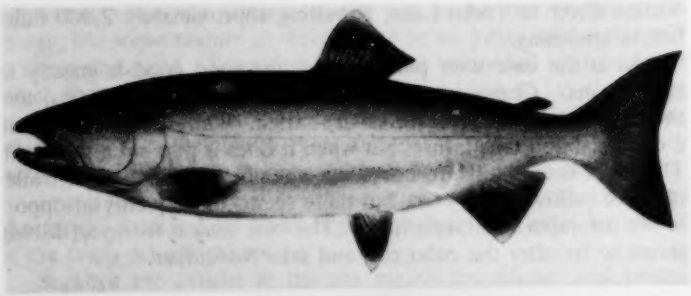
Quick Check.—The fine scales and the presence of oval blotches on the back and tail fin should distinguish this species from other salmon.

Notes.—Pink salmon live only two years. They begin life as fry which emerge from the gravel in the spring and migrate almost at once down-stream to the sea. Major growth takes place in the second season; by fall the adults enter streams to spawn and to die. Breeding fish usually spawn not far above tidal water, but ocassionally some travel long distances; for example, to the upper reaches of the Skeena River.

In most areas throughout the range of the pink salmon there is a large run in one year followed by a small run in the next year or by no run at all. In the northern part of its range the large runs occur in the even years, while in the southern part they are in the odd years. Efforts to build up runs in the off years have so far failed.

Pink salmon feed mainly upon euphausids and similar crustaceans.

Pinks are taken commercially in purse-seines and gill-nets primarily for the canning industry. They are also often taken on trolling-gear, so that they enter into the sport fishery in some areas. Successful lures used by anglers include a dodger with a Tom Mack spoon or minnow or any lure bright red in colour combined with a minnow. The best time of the year seems to be late August and into September.



Chum Salmon
Dog Salmon

***Oncorhynchus keta* (Walbaum)**
keta=Russian word for salmon.

Description.—Similar in general appearance to other salmon but with a more slender peduncle. Gill rakers on the first arch, 19 to 26. Rays in the anal fin, 13 to 17. Scales in the first row above the lateral line, 130 to 153.

Colour: Metallic blue or black, silvery on sides. No black spots but fine dark speckles may be present on the back. The pectoral, anal, and tail fins may be edged in black in males. As adults reach maturity, irregular reddish or dusky bars develop on the sides of the body and white tips appear on the ventral and anal fins.

Size: Length to 38 inches and weights usually from 8 to 18 pounds.

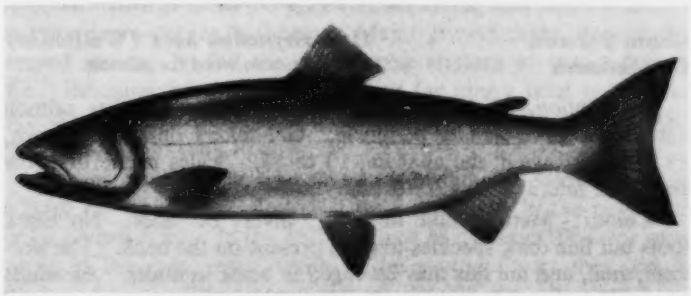
Range: Alaska to San Francisco and south on the Asiatic coast to Kamchatka.

Quick Check.—The absence of spots, the slender peduncle, and the black edging to all fins (except the dorsal) are key characters. In mature fish the dusky bars across the sides are diagnostic.

Notes.—The usual life-span of chum salmon is four years. The young appear in streams in the spring and drop down to the sea almost immediately. Very little is known of their travels in salt water, except that adults enter Georgia Strait by way of Johnstone Strait as well as Juan de Fuca Strait. Breeding fish ascend nearly all coastal streams, spawning generally at no great distance from salt water. However, in the north they ascend the

Yukon River to Teslin Lake, travelling approximately 2,000 miles before spawning.

As is the case with pink salmon, the food consists mostly of crustaceans. Chums are taken by purse-seines and gill-nets, and the catch is canned, frozen, or dry-salted. Only occasionally will a chum salmon take a lure, but when it does it puts up a fine fight. The most successful lure has been a double flasher with a trailer made of yellow nylon yarn, but there seems to be plenty of opportunity for experimentation here. The best season for sport fishing seems to be after the coho run and into November.



Sockeye Salmon ***Oncorhynchus nerka* (Walbaum)**

nerka = Russian name.

Description.—Similar in general appearance to other salmon. Gill rakers on the first arch, 30 to 39, long, slender, and closely set. Rays in the anal fin, 13 to 17. Scales in the first row above the lateral line, 125 to 143.

Colour: Greenish-blue on the back, silver on sides. No black spots, but dark specklings on upper surface. Green head and red sides in mature male, less brilliant in the female. Flesh, rich red.

Size: Length to 33 inches and weight up to 15 pounds, but usually from 3½ to 8 pounds.

Range: Alaska to Klamath River (California) and westward to Japan.

Quick Check.—The greenish-blue back with speckles but no spots, and the numerous fine gill rakers are diagnostic.

Notes.—Sockeye salmon usually live to be four or five years of age, but some mature at three, some at six years, and fewer still at seven and eight. Spawning fish appear in the fall in streams on which there are lakes and pass through the lakes to lay their eggs in the tributary streams. The young sockeye hatch in the spring and spend one, frequently two, and occasionally three years in fresh water, eventually passing to the sea, where they mature.

In salt water they feed mostly on euphausids and other shrimp-like forms, straining the small organisms from the water by means of the finely set gill rakers.

Sockeye are caught in the sea mainly by gill-net and purse-seine, and almost the whole catch is canned. A few are taken on trolling-gear, usually on "egg spoons" by commercial fishermen or on dodger and herring by sportsmen. There is considerable possibility that an artificial lure can be invented for this fish that would open a new field for the angler.

The landed value of sockeye taken in 1958, the largest catch in 50 years, was $20,356,000.

The name "sockeye" is said to be a corruption of the Coast Salish name "suk-kegh": it is called red salmon in Alaska.

Eulachon
Candlefish

***Thaleichthys pacificus* (Richardson)**
Thale/ichthys=rich fish (referring to the high oil content).
pacificus=of the Pacific.

Description.—Much like the silver smelt but with a more pointed snout and larger mouth. Upper jaw extending to or beyond the back margin of the eye. Adipose fin present. Tail well forked.

Anal fin with 20 or 23 rays. Ventral fins originating well in front of the origin of the dorsal fin.

Colour: Bluish or iron-grey on the back; whitish below. A few fine black stipplings on back.

Size: Length to 12 inches.

Range: North-western Alaska to northern California.

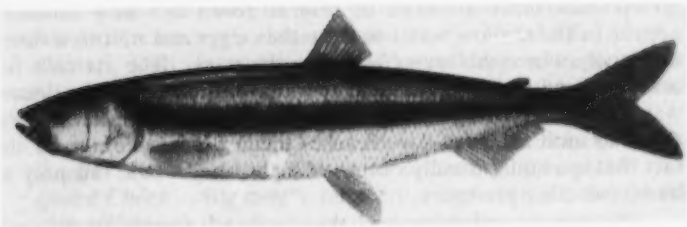
Quick Check.—The presence of the adipose fin, the long mouth, and the ventral fins placed in advance of the dorsal are characteristic.

Notes.—Eulachons spend most of their life in the sea, presumedly in coastal waters. In the spring, mature adults, usually in their second or third year of life, appear in great numbers off the mouths of mainland rivers from California to Alaska. They enter fresh water and travel up-stream sometimes many miles to spawn over sand and gravel bars. The eggs sink, and on contact with the bottom the sticky outer membrane ruptures to form an anchor to fasten each egg securely to the bottom. Soon after hatching the young drift downstream to enter the sea. The adults die after spawning.

The spawning run takes place in March, April, and May, earliest in the more southern rivers and latest in the north. In the Fraser a commercial fishery is carried on entirely by means of gill-nets.

Eulachons were one of the chief sources of oil or grease for the Indians of the coast. For this reason the natives gathered great numbers of these fish each spring. In the old days, basket traps and nets were used to gather fish, as well as a rake, much like a modern herring rake in design. Nowadays the fish are collected mostly by nets staked out below the spawning-beds.

Eulachons are very oily, so much so that they will burn in the dried state. It is said that early white settlers used the fish to make an emergency light, hence the common name "candlefish."



Surf Smelt
Silver Smelt

***Hypomesus pretiosus* (Girard)**
Hypo/mesus = below the middle, referring to the position of the ventrals.
pretiosus = precious.

Description.—A small silvery fish. Mouth small, upper jaw extending just beyond the front margin of the eye. An adipose fin present. Tail well forked. Anal fin with 14 to 16 rays. Ventral fins originating just behind the origin of the dorsal fin.

Colour: Olive-green on the back, silvery to white on the belly. A metallic silvery band along each side. Back of mature male darker than that of female.

Size: Length from 6 to 10 inches.

Range: South-eastern Alaska to northern California.

Quick Check.—The presence of the adipose fin, the silver stripe, and the ventral fins behind the dorsal are characteristic.

Notes.—The surf smelt apparently is found all along the British Columbia coast, but is most commonly seen in the vicinity of Vancouver, in Boundary Bay, and around southern Vancouver Island. Here it appears in the summer months to spawn on sandy beaches. Egg-laying usually takes place where the waves break on the sand or fine gravel and almost invariably on a falling tide and preferably in the evening. A single female spawns more than once each day, and several days are required for all ripe eggs to be laid. Individual fish spawn more than once during the season (Schaefer, 1936). Since spawning fish seem to prefer spring tides (as opposed to neap tides) and at a time when successive daily tides are on the decrease, spawning in most areas occurs roughly at two-week intervals and generally during calm weather.

At such times a school of several dozen fish may suddenly appear in the shallow water to drop their eggs and milt in a flurry of activity where the waves break on the sand. The act calls for a split-second timing if the fish are to be carried back into deeper water by the receding wave. Those that fail may flop around on the sand until the next wave reaches them. If it were not for the fact that spawning usually occurs at night, they would fall prey to birds and other predators.

The eggs are adhesive, and they probably remain in the sand for 10 to 14 days, that is until the next series of spring tides, when they hatch on contact with water, as is the case with the grunion of the California coast. Adults mature in their first, second, or third year. Females tend to be larger than males.

The surf smelt is taken commercially by seine and gill-net for the fresh-fish market, and some are taken by beach fishermen using seines, scoop-nets, and small gill-nets. Several decades ago smelt-fishing was a popular sport along the beaches of the Vancouver area, but relatively few fish are now left to support this sport.

Hake ***Merluccius productus* (Ayres)**

Mer/luccius = an ancient name meaning sea pike.
productus = drawn out.

Description.—An elongated fish with soft flesh and rather fragile fins. Head long and conical, mouth and eye large. W-shaped ridges on top of head. Two dorsal fins; the first short, triangular; the second long, almost divided in two parts by a notch. Tail fin only slightly forked. Anal fin long and divided like the second

dorsal. Ventral fins well forward of the pectorals. Pectorals long, reaching to the anus. Scales small and easily rubbed off.

Colour: Dull silvery-grey with dark speckling on the top of the head and back; whitish on the belly. Black inside the mouth and gill covers.

Size: Length to 3 feet (16 to 18 inches in Victoria vicinity).

Range: North-western Alaska to southern California.

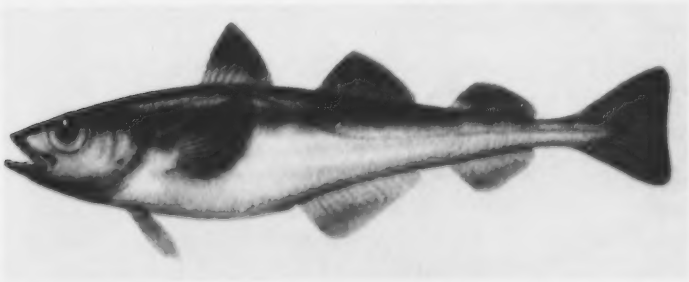
Quick Check.—Big mouth, large eye, ridges on head, two dorsal fins, black lining to the mouth, and general flabby appearance.

Notes.—The hake is a cod-like fish that differs from the true cods in having the second dorsal fin incompletely divided and in lacking a barbel under the chin.

They are taken incidentally in some numbers in traps, trawls, seines, and gill-nets, but they are not saved for the market because the soft flesh will not stand the necessary handling. The fish are unattractive to the eye though reasonably palatable to the taste.

Occasionally hake are taken on trolling-gear in Saanich Inlet, where they arouse comment among sport fishermen.

Hake are reported to eat small fishes and squids.



Whiting

***Theragra chalcogrammus* (Pallas)**

Ther/agra = beast; prey or food (chief food of fur seal in Alaska).
chalco/grammus = brass; line.

Description.—A typical cod in general appearance. Mouth fairly large; lower jaw projecting slightly, no barbel beneath the

tip or, if present, very small. Eye large. Three dorsal fins, each well separated. Tail-fin margin slightly concave. Two anal fins, well separated. Ventral fins well forward of the pectorals. Anal opening below the interspace between first and second dorsal fin.

Colour: Greenish to brown on the back with darker mottlings; silvery on sides and belly. Fins blackish. Young fish have 2 or occasionally 3 narrow yellowish bands along each side, sometimes each broken up into a series of blotches.

Size: Up to 3 feet.

Range: North-western Alaska to northern California.

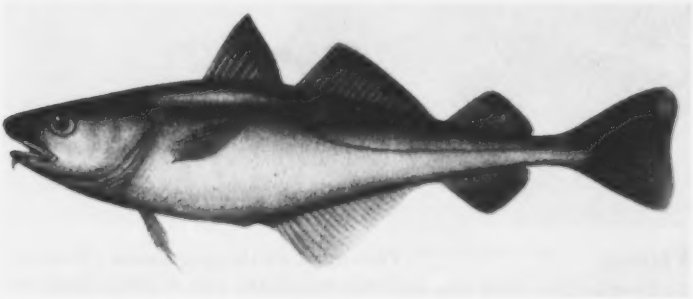
Quick Check.—Cod shape, projecting lower jaw, barbel small or lacking, anus below first interspace.

Notes.—The whiting is a true cod, though it often lacks the barbel which is characteristic of most members of the family.

It occurs in considerable numbers along the entire British Columbia coast and is regularly taken by trawls and seines. The catch is used both as food for man and for mink. The flesh is very palatable and in fair demand.

Whiting feed mainly upon plankton crustacea, but they also take small herring.

Among some commercial fishermen this fish is known as "big eye."



Tomcod

***Microgadus proximus* (Girard)**

Micro/gadus = little; cod.
proximus = near (close to original tomcod).

Description.—A typical cod in general appearance. Mouth fairly large; lower jaw not projecting, small barbel beneath the tip. Eye small. Three dorsal fins, each slightly separated. Tail-fin margin slightly concave (convex in small fish). Two anal fins well separated. Ventral fins well forward of the pectorals. Anal opening below first dorsal fin.

Colour: Dark green on back, paler on sides, shading to creamy white on belly. Tips of dorsals, tail fin, and second anal blackish.

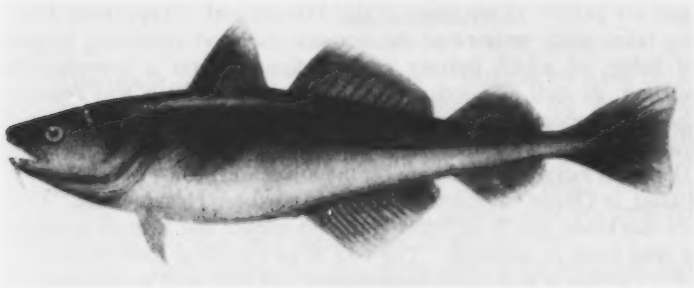
Size: Length up to 12 inches.

Range: North-western Alaska to northern California.

Quick Check.—Cod shape, receding lower jaw with small barbel, anus below first dorsal fin.

Notes.—The tomcod is the smallest of our true cods, seldom exceeding a foot in length. Small numbers are taken in bottom trawls at depths ranging from 15 to 50 fathoms, and some are taken by anglers in shallow water near shore. The flesh is quite palatable, but is seldom available on the market because the fish rarely attains the minimum size requirement of 3 pounds.

Mr. Willie Egeland, commercial fisherman at Sidney, B.C., reports that tomcod spawn in November.



Pacific Cod ***Gadus macrocephalus* Tilesius**

Gadus = cod.
macro/cephalus = big; head.

Description.—A typical cod in general appearance. Mouth relatively small; lower jaw not projecting, barbel beneath the tip.

Eye small. Three dorsal fins, each well separated. Margin of tail fin slightly concave (convex in small fish). Two anal fins well separated. Ventral fins well forward of the pectorals. Anal opening below the second dorsal fin.

Colour: Grey to brown on the back, lighter on sides and belly; numerous dark-brown or golden-brown spots on back and sides, sometimes in the form of mottling. Fins dark with whitish margins on dorsals, anals, and tail.

Size: Up to 3 feet, 3 inches.

Range: North-western Alaska to California (Piedras Blancas Point).

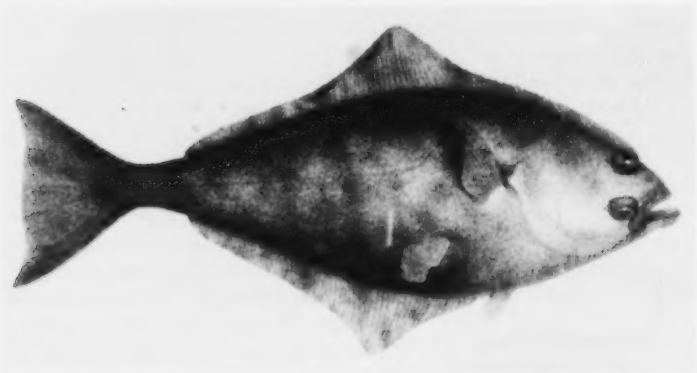
Quick Check.—Cod shape, receding lower jaw with prominent barbel, anus below second dorsal fin.

Notes.—"The species is exploited as far south as Oregon, but is particularly important in the north. It is the true cod of the Pacific, resembling the Atlantic species, *G. morrhua*, very closely in appearance and habits. There is a seasonal migration from deep to shallow water in the spring of the year. Specimens have been taken at depths of 200 fathoms as well as in shallow water around wharves. Spawning takes place in late winter and undoubtedly the eggs are pelagic as are those of the Atlantic cod. Apparently feeding takes place near or at the bottom, the food consisting largely of fishes, of which herring and sandlances form a considerable portion, as well as various crustaceans. In 1958 it had become the most important species in the British Columbia and Washington trawl fisheries, with the annual catch exceeding 20 million pounds. The main fishing grounds are off the lower west coast of Vancouver Island, in Queen Charlotte Sound, and northern Hecate Strait. Cod are marketed chiefly as fillets and 'fish sticks,' but a small quantity is sold fresh or smoked. The cod is an excellent food product if after capture it is dressed immediately and iced with a minimum of handling." (Clemens and Wilby, 1961.)

The Pacific cod grows rather quickly, reaching a length of 22 inches by the end of its third year. The average age in the commercial catch is 4 or 5 years, but some fish may reach an age of 10 years and a length close to 3 feet. Maturity is reached in 3 or 4 years. (Fisheries Fact Sheet No. 63, Dept. of Fisheries, Ottawa.)

This species is known as " grey cod " by commercial fishermen.

Two other true cods are found in British Columbia—the long fin cod (*Antimora rostrata*), a deep-water species, and the ling or burbot (*Lota lota*), found in fresh water.



Halibut ***Hippoglossus stenolepis* Schmidt**

Hippo/glossus = horse, tongue; the ancient name of the halibut.
steno/lepis = narrow scaled.

Description.—A large flat fish, usually adapted for lying on its left side. Mouth large, upper jaw ending below the eye; teeth conical. Eyes large, the left (upper) slightly behind the right. Dorsal fin long, extending from a point opposite the left eye to the peduncle; 89 to 109 rays. Tail fin with shallow fork. Anal fin long, with 64 to 81 rays. Lateral line curved over pectoral fin, then straight. Scales very small, smooth and narrow.

Colour: Dark brown on the upper side, with irregular light blotches. White on the underside.

Size: Males to 4 feet 7 inches and a weight of 40 pounds; females to 8 feet 9 inches and a weight of 470 pounds.

Range: North-western Alaska to northern California (Piedras Blancas Point).

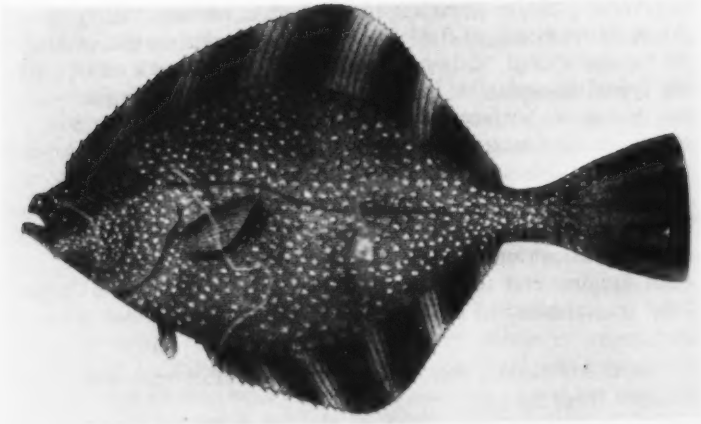
Quick Check.—Large size, arched lateral line, small smooth scales.

Notes.—The halibut is the largest and most valuable of the bottom fishes. It is found along the entire coast of British Columbia, from relatively shallow water to at least 600 fathoms. Spawning occurs from November to January in well-defined areas, ranging in depth from 150 to 255 fathoms. The eggs and newly hatched young drift with the currents at depths down to 375 fathoms, gradually rising toward the surface as development proceeds and drifting into shallow water with the inshore surface currents. The young fish at first swim upright, but by spring they begin to turn onto the left side, the left eye moving over the top of the head to the new position. Eventually the young fish settle to the bottom in shallow water, and as they grow older they move into deeper water. Females grow faster than males and average 12 years of age at maturity. A female of 140 pounds may produce 2,700,000 eggs, and females may live to be 35 years old. Males mature earlier than females and may attain an age of 25 years.

Halibut hook, Indian style.

Food consists of fishes, crabs, clams, squids, and other animal forms. Most halibut are taken on set-lines baited with herring, squid, or octopus. Occasionally individuals are taken on trolling-gear and in otter trawls. The catch has doubled in the last 20 years and now averages 23,000,000 pounds, valued at about $5,000,000. The industry has been managed by the International Pacific Halibut Commission since 1928, an outstanding example of practical conservation.

Mature fish migrate extensively to and from the spawning-grounds. Marked individuals have travelled as much as 2,000 miles.



Starry Flounder ***Platichthys stellatus* (Pallas)**

Plat/ichthys = flat, fish.
stellatus = starry.

Description.—A medium-sized flatfish, adapted for lying on either its right or left side. Mouth small, lower jaw projecting. Small teeth, mostly on lower side of jaw. Eyes small. Dorsal fin long, extending from a point opposite the eye to the peduncle; 52 to 66 rays. Tail fin square cut. Anal fin long with 38 to 47 rays. Lateral line slightly curved then straight. Scales small, in form of spiny, star-shaped plates well separated and scattered over the upper surface.

Colour: Brown to nearly black on the upper side; dorsal, anal, and tail fins white, orange-yellow or reddish-orange with black bands or stripes parallel to the rays. Underside cream or white.

Size: Length to 3 feet and weight to 20 pounds. Average length in shallow water about 20 inches.

Range: North-western Alaska (Kodiak Islands) to southern California. On the Asiatic side, south to Amar River.

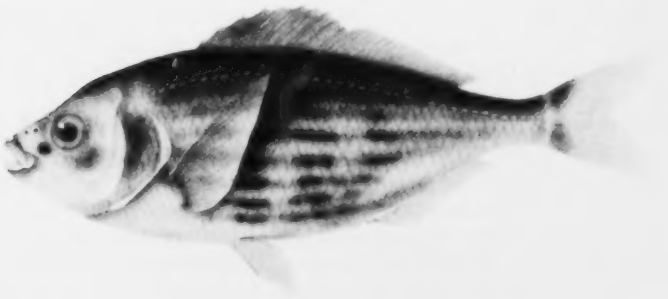
Quick Check.—Medium size, black bars on fins, scattered prickly scales.

Notes.—Starry flounders spawn in late winter or early spring. As in other species of flatfishes, the young swim upright at first as do " conventional " fishes but eventually come to rest on one side, the eye of the underside in the meantime migrating over the head to the new upper surface. Most members of the species lie with the right side up (dextral), but sometimes a high proportion develop with the left side uppermost (sinestral).

Starry flounders are found all along the coast on sandy bottom, usually in shallow water but occasionally in deep water. They feed upon all manner of animal forms, including crabs, shrimps, worms, clam siphons, and small fishes. They have some value as a food fish; several hundred thousand pounds are taken by bottom trawl each year.

Small individuals may sometimes be found in fresh water some distance from the sea.

A number of other flatfishes, variously called " sanddabs," " flounders," and " soles," are found in British Columbia, and some of them are of considerable economic importance.



Yellow Shiner
Shiner Seaperch

***Cymatogaster aggregata* Gibbons**
Cymato/gaster=fœtus; belly.
aggregata=crowded together (schooling).

Description.—A small silvery perch-like fish. Head short; mouth small and bordered with fleshy, protrusible lips. Dorsal fin long with 9 or 10 spines followed by 18 to 23 rays. Tail fin strongly forked. Scales large, 38 to 46 along the lateral line.

Colour: Silvery with dark black and series of dark, longitudinal stripes on sides. Three vertical yellow bars on each flank. Males are very dark in winter and early spring.

Size: Up to 6 inches, rarely to 8.

Range: South-eastern Alaska to southern California.

Quick Check.—Perch shape, large scales, and the three vertical yellow bars.

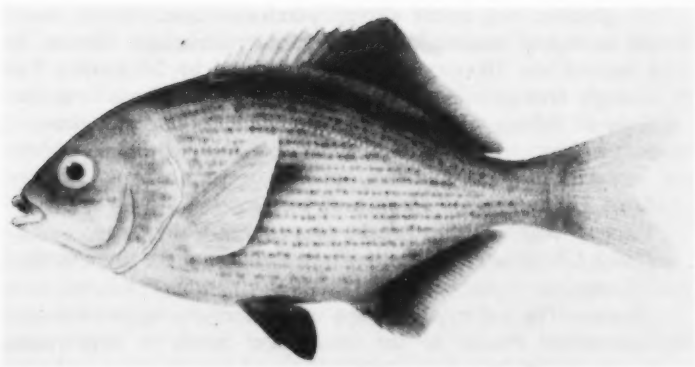
Notes.—The yellow shiner is a member of the seaperch family and somewhat similar to the fresh-water perch in appearance. In the summer months it is commonly found in schools around piles and beneath floating wharves, where it searches among the barnacles and mussels for small animals as food. In the winter it lives in deeper water, sometimes being taken in shrimp trawls at 40 fathoms.

Shiners are easily taken on a hand-line, providing the hook is of the smallest size obtainable. A small portion of mussel or a minute piece of seaworm can be used as bait, though it has to be constantly replaced as the fish are adept at removing tidbits from the hook without being caught. Despite the presence of numerous bones, shiners are an acceptable pan fish; large numbers are eaten, particularly by Chinese.

As is the case with all seaperches, young are born alive. Mating is said to take place in spring and early summer, and birth occurs 10 to 12 months later. The number of young produced ranges from 8 to 36.

The method of reproduction in the seaperch family (*Embiotocidæ*) is so unusual it merits some attention. In the male the modified anal fin is used to transfer sperm to the female, in which it is stored until required. The young develop in the ovary and obtain food and oxygen from the mother by special means somewhat similar to the placental arrangement in mammals. When born the young are well developed and ready to shift for themselves.

All seaperch are protected by a closed season during the months of June, July, and August in each year.



Striped Seaperch ***Embiotoca lateralis* L. Agassiz**

Embio/toca = lively, offspring.
lateralis = of the side.

Description.—A perch-like fish. Head short; mouth small with fleshy lips. Dorsal fin long with 10 to 12 spines followed by 23 or 24 rays. Tail fin strongly forked. Anal fin in male with gland-like structure at front end. Scales small, 63 to 65 along the lateral line.

Colour: Reddish-brown, darker on the back and with many dark speckles. Longitudinal blue and orange stripes on the sides. Dorsal, tail, and ventral fins dusky in males in spring months.

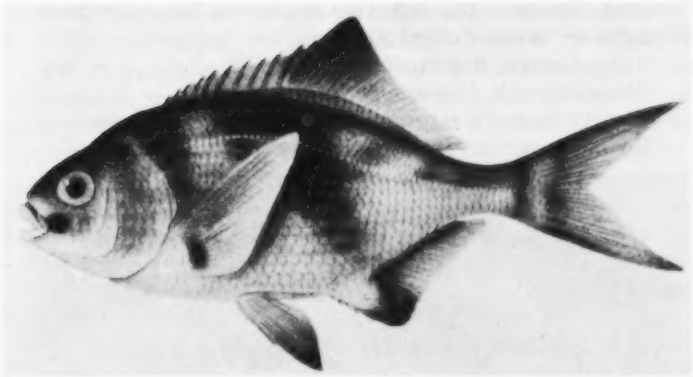
Size: Up to 12 inches, occasionally to 15.

Range: South-eastern Alaska to southern California (San Benito Islands).

Quick Check.—Perch shape, small scales and the blue and orange stripes.

Notes.—Striped seaperches are often seen around wharf pilings in the summer months. Here, they can occasionally be taken on a hand-line, though they usually ignore a baited hook. They feed upon small crustaceans, worms, herring eggs, and other animal material cropped from piles and rocks.

The young are born during the summer; as many as 44 have been found in one female.



Pile Seaperch ***Damalichthys vacca* Girard**

Damal/ichthys=calf, fish.
vacca=like a cow.

Description.—A perch-like fish. Head short; mouth small with fleshy lips. Dorsal fin long with 10 spines followed by 21 to 24 rays. Tail fin strongly forked. Scales small, 56 to 67 along the lateral line.

Colour: Brownish on back, fading to silver on sides and belly. Three or four dusky blotches on upper part of sides. A dark spot on cheek below the eye. Dusky shading on dorsal, tail, and anal fins. Ventral fins yellowish or pale orange, tipped with black.

Size: Length 12 to 15 inches.

Range: North-western Alaska to southern California.

Quick Check.—Perch shape, small scales, dusky bars, and black cheek-spot.

Notes.—Dusky seaperch are sometimes seen schooling in shallow water. Large numbers were seen by a Museum field party over sand flats at Spring Island, Kyuquot area, in early July, 1958.

The portions of the scientific name referring to calf and cow allude to the habit of this fish of giving birth to living young.

Other species: The following seaperches have also been recorded from British Columbia:—

Kelp seaperch, *Brachyistius frenatus* Gill.

White seaperch, *Phanerodon furcatus* Girard.

Walleye seaperch, *Hyperprosopon argenteum* Gibbons.

Redtail seaperch, *Holconotus rhodoterus* Agassiz.

Sablefish ***Anoplopoma fimbria* (Pallas)**

Anoplo/poma = unarmed gill cover.
fimbria = fringed.

Description.—A streamlined fish. Head long and cone shaped. Mouth not large; lower jaw not projecting. Two pairs of nostrils. Two dorsal fins, well separated, the first with 17 to 21 spines. Tail fin well forked. Pelvic fins well forward, below pectoral fins. Scales small, slightly rough to the touch, in about 190 rows above the lateral line. Lateral line fairly high and parallel with upper body outline.

Colour: Black, dark grey or greenish-grey on back and upper sides sometimes with dark wavy lines, fading to grey on the belly. Black margin on first dorsal fin; light margins on other fins. Black on inner lining of the gill cover and on the lining of the body cavity.

Size: Length to 40 inches, weight to 40 pounds.

Range: North-western Alaska to southern California.

Quick Check.—Streamlined body, two dorsal fins, two nostrils, black lining to gill covers.

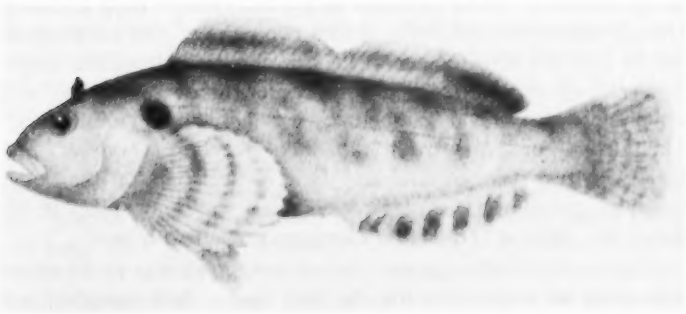
Notes.—The sablefish is common along most of the British Columbia coast, particularly in northern waters. It is taken com-

mercially by trawl and set-line in depths down to 170 fathoms. Most fish are smoked and sold under the name of "black cod."

Off Victoria and in Saanich Arm small sablefish about 14 or 15 inches in length are taken by sports fishermen in late fall of some years. Sablefish of this size are also reported to gather in estuaries of rivers, where they feed heavily on young salmon.

Sablefish also prey upon crustaceans and worms. They reach maturity in six to eight years, when they may be about 28 inches long. They spawn in the spring, and the eggs float free in the water. Young in early stages of development have been taken near the surface 100 to 185 miles off the coast of Oregon in the latter part of May.

The sablefish belongs to the skilfish family, which is represented in British Columbia by one other member, the giant skilfish (*Erilepis zonifer* (Lockington)), which may attain a weight of 200 pounds. The "mystery fish" which lived in the Vancouver Public Aquarium for several years was of this species.



Rock Greenling ***Hexagrammos superciliosus* (Pallas)**

Hexa/grammos = six lines (actually, there are only five lateral lines).
Super/ciliosus = pertaining to the eyebrow.

Description.—A highly coloured, elongated fish. Head short and conical; mouth small. No spines on cheek or gill cover, but a large plume-like structure (cirrus) over each eye. Dorsal fin

long, divided into two parts by a shallow notch. Tail fin rather square cut or slightly rounded. Anal fin long. Ventral fins well forward. Pectoral fin very broad and rounded. Five lateral lines; the usual one along the mid-line, plus 2 above and 2 below. Scales rough to the touch (ctenoid).

Colour: Usually red, brown, or green with darker blotches on back and sides. Two red stripes on cheek downward and backward from the eye and red on the throat. A dark spot above the base of each pectoral fin and 3 dark cross-bars on pectoral fin.

Size: Length to 24 inches.

Range: North-western Alaska to southern California.

Quick Check.—Bright colours with dark spot over base of side fin; 5 lateral lines, rough scales, and plume-like cirrus over the eye.

Notes.—The greenlings are represented by six species of fish in British Columbia, including the well-known lingcod. All are rather highly coloured fishes found around rocks and kelp-beds all along our coast. Other members of the family are: Kelp greenling (*Hexagrammos decagrammus*), with two pairs of cirri on the head and an eye-spot near the end of the dorsal fin; whitespotted greenling (*Hexagrammos stelleri*), with one cirrus over each eye and white spots on the body, sometimes wrongly called "tommycod," "kelp trout," or "rock trout"; painted greenling (*Oxylebius pictus*), with two pairs of cirri and dark vertical bars on the body; longspine greenling (*Zaniolepis latipinnis*), with long spines in the dorsal fin; lingcod (*Ophiodon elongatus*), dealt with later.

Due to their rather spectacular colours, greenlings excite attention when they are seen for the first time. Although they are relatively common around kelp-beds, they are not regularly taken by the average angler. The flesh is very palatable.

Lingcod ***Ophiodon elongatus* Girard**

Ophio/don = snake, tooth.
elongatus = long.

Description.—An elongated big-mouthed fish. Head long and conical; mouth large with large teeth and projecting lower jaw. Plume-like cirrus over each eye. Three to five spines on cheek. Dorsal fin long, with 24 to 27 spines in the first part, separated from the second part by a shallow notch. Tail fin almost square cut. Anal fin long. Ventral fins well forward. Pectoral fins very broad and rounded. Lateral line following curve of back at first then dipping down and running straight for the last one-fifth of its length.

Colour: "Dark on dorsal surface, ranging from black, brown, blue to green; dusky greenish gray or dusky cream on ventral surface; frequently mottled on back, sides, and dorsal and anal fins; grayish green on pectoral, pelvic and anal fins; males often with large dark greenish brown areas on back and sides outlined with tracings of pale blue or orange; females similarly marked but usually lighter, with orange tracings rather than blue, small orange spots scattered amongst the larger areas; colours and colour patterns varying with habitat and subject to rapid changes." (Clemens and Wilby, 1961.)

Size: Length up to 5 feet; weight in excess of 60 pounds. (Fish over 6 feet long and over 90 pounds in weight have been reported but not verified.)

Range: North-western Alaska to southern California (San Diego).

Quick Check.—Long, mottled body; long dorsal fin with shallow notch; large mouth and teeth; cirrus over each eye.

Notes.—The lingcod " is common along the northeastern shore of the Pacific with the centre of abundance in British Columbia waters. It is taken by trolling, in otter trawls and on jigs using live herring for bait. The habitat is near the bottom of the intertidal zone down to at least 60 fathoms, amongst the kelp-beds, and reefs, especially where there are strong tidal movements. The fish when resting on the bottom supports its weight on its pectoral and pelvic fins. Spawning takes place from late December to February or March. The female deposits her eggs in a sheltered rocky location in large adhesive pinkish white masses below the lowest tide level. Individuals 34 to 46½ inches in length have been found to contain 170,000 and 476,000 eggs respectively. After fertilizing the eggs the male guards them until they are hatched. He fans the eggs with his pectoral fins to keep up a good circulation of water and drives off all enemies with fierce rushes, biting at any approaching intruder. The young hatch with small yolk-sac attached and can be identified by the bright yellow oil globule near the liver, the large blue eyes and the elongate body. Little is known of the post-larval stages but young fingerlings from 3 to 5 inches in length are taken occasionally by seining in the eel-grass during the summer. Tagging operations have not indicated a regular migration but merely local random movements, the greatest distance recorded being 80 miles. The lingcod feeds chiefly upon herring and other fishes such as flounders, hake, cod, whiting and younger lingcod although various crustaceans and squid remains have been found in stomach contents. The juveniles feed upon copepods and other small crustaceans.

" The lingcod is highly esteemed as a fresh fish. It is used extensively in restaurants and is available at all seasons of the year. . . . The flesh of the adults is almost white and of the young is sometimes intensely green. The green colouring matter is not harmful and all trace of it disappears upon cooking. This fish has been found to be one of the richest sources of insulin amongst the fishes of the world. The liver oil is remarkably rich in vitamins 'A' and 'D,' assays showing highest ranges of potency of any

known fish or selachian oil from British Columbia waters." (Clemens and Wilby, 1961.)

The lingcod is a favourite quarry of the skindiver because of its large size and occasional aggressiveness. Divers have reported several instances of threatened attack, and on one occasion a large fish seized a swimmer's arm and drew blood. Males are most likely to be pugnacious when guarding eggs on a nesting-site. Fish as large as 60 pounds in weight have been taken by spear, and even larger individuals have been observed.

Spear and " hee-hee."

The Indian method of fishing for lingcod was ingenious. A lure called a " hee-hee," of wood and fibres in the shape of a shuttle-cock, was pushed down toward the reef with a long three-tined spear. When the spear was sharply withdrawn, the " hee-hee " spun slowly to the surface followed by the curious or hungry lingcod. When the fish came within striking distance, it was speared and landed. (Fisheries Fact Sheet No. 71.)

Nowadays lingcod are taken mostly by trawl from the west coast of Vancouver Island, and by line in the Strait of Georgia. Chrome-plated Swedish jigs have largely replaced those formerly made of lead.

The minimum legal size for lingcod is 3 pounds when dressed and the head removed. Fishery regulations or officials should be consulted concerning closed seasons and other restrictions.

Copper Rockfish ***Sebastodes caurinus* (Richardson)**

Sebastodes = magnificent.
caurinus = of the north-west (wind).

Description.—A blotchy bass-like fish. Head rather short. Mouth large with lower jaw extending slightly beyond snout. Five blunt spines on cheek-bones; 2 on gill cover. Two portions of dorsal fin separated by a shallow notch; first portion with 13 spines. Anal fin with 3 spines and 6 rays; second and third spines equal. Ventral fins with 1 spine and 5 rays, placed below pectorals. Pectorals long, reaching behind anus; outer third of lower rays markedly thickened. Scales moderate, in 40 to 48 oblique rows above the lateral line. Very small scales on lower jaw below tip.

Colour: Dark brown to dark green, blotched with coppery brown on sides and paling to light brown on belly. Several dark bands on cheek radiating from eye. Fins dark; coppery brown on spinous dorsal; thickened portion of pectoral spines whitish. Peritoneum white.

Size: Length to 20 inches.

Range: South-eastern Alaska to Oregon.

Quick Check.—Coppery colour in blotches, protruding lower jaw, pectoral fin reaching behind anus, small scales on lower jaw below tip.

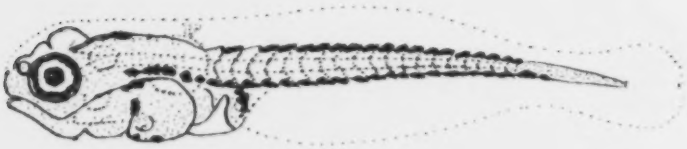
Notes.—Rockfishes are commonly called " rock cod," which is not a good name since they are in no way related to cod.

The copper rockfish is the species most likely to be taken in shallow water around Vancouver Island and in the Strait of Georgia area. It readily takes a spoon, herring strip, or similar lure, and consequently is often caught by sports fishermen when they troll close to shore along a rocky coastline, and since it is easily approached by skindivers, many are taken by spear.

Rockfishes do not lay eggs. In all species the young are born alive in a rather immature condition, measuring less than one-half inch in length. Great numbers may be produced each summer. One species, the orange rockfish, sometimes contains as many as 600,000 young, and a large red rockfish (snapper) may carry as many as 2,700,000 unhatched eggs.

In the copper rockfish, developing eggs are found from March to May in the Georgia Strait area. A 15¾-inch fish was found to contain about 215,000 young. At birth the larvæ are from 5 to 6 mm. long (one-quarter inch), and spawning occurs annually once maturity is attained. (Hitz and DeLacey, 1959.)

When taken commercially, this fish is prepared for sale as filets.



Larva of copper rockfish (enlarged).

Bocaccio ***Sebastodes paucispinis* (Ayres)**

pauci/spinis = few-spined.

Description.—A bass-like fish. Head long and pointed. Mouth large with lower jaw extending well beyond snout. Three or four spines on cheek-bone; 2 on gill cover, the upper larger. Dorsal fins in two parts, the first with 13 or 14 sharp spines. Anal fin with 3 spines and 7 to 9 rays. Ventral fins with 1 spine and 5 rays, placed below pectorals. Scales small, in 90 to 105 rows.

Colour: Green to brown on back, shading to reddish bronze on sides and whitish on belly. " . . . everywhere flushed with clear pale red, often with intense black spots on body; red on lower jaw, black on tip; white to silvery on peritoneum." (Clemens and Wilby.)

Size: Length to 3 feet.

Range: Queen Charlotte Sound south to southern California (San Diego).

Quick Check.—Bass shape, 13 or 14 spines in first part of dorsal fin, projecting lower jaw.

Notes.—The name " bocaccio " means large mouth. " It is included frequently in commercial catches of rockfishes from Juan de Fuca Strait and the west coast of Vancouver Island. The species usually occurs at depths below 40 fathoms. The food consists of small fishes. It is a relatively swift-moving rockfish and in Howe Sound has become a popular sport fish in deep trolling with light

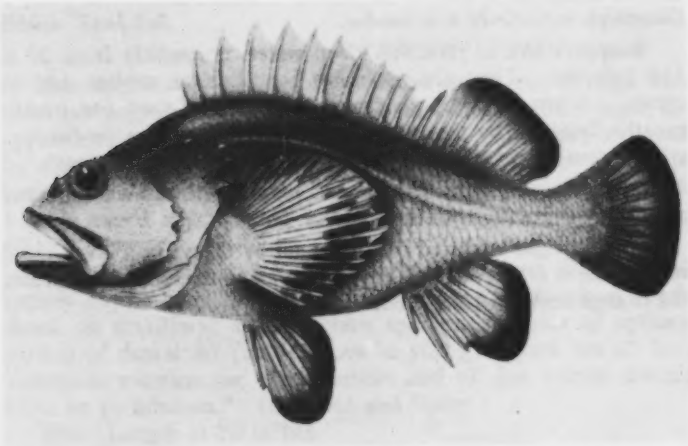
tackle using herring skin for a lure. In California it is an important commercial species." (Clemens and Wilby.)

Bocaccios occur in large numbers on the surface in Finlayson Arm, Saanich Inlet, usually in the spring toward the end of the blueback season, at which time they may take bucktail flies readily.

As in all rockfishes, very small young are produced alive in great numbers during the summer months. Immature rockfish must be very abundant in offshore waters because they are often found in the stomachs of albacore (tuna).

Rockfishes in general are rather slow growing, as indicated by a study of scales. Most do not attain commercial size until they are 8 or 10 years old and some apparently live as long as 25 years.

The bocaccio is called " rock-salmon " by commercial fishermen.



Red Snapper
Red Rockfish

***Sebastodes ruberrimus* Cramer**
ruberrimus=very red.

Description. — A red-coloured bass-like fish. Head stout; mouth large with lower jaw only slightly projecting. Spines on cheek broad, some with 2 and 3 points. First part of dorsal with

13 spines and separated from second part by moderate notch. Anal fin with 3 spines (the second longest) and 7 rays. Ventral fins with 1 spine and 5 rays, placed below pectorals. Scales medium, in 50 to 52 rows.

Colour: Vermilion on back and sides, paler on belly. Light streak usually along lateral line. Black spots commonly on head and back. Fins red with black margin, except on spiny portion. White peritoneum.

Size: Length to 3 feet.

Range: North-western Alaska to southern California.

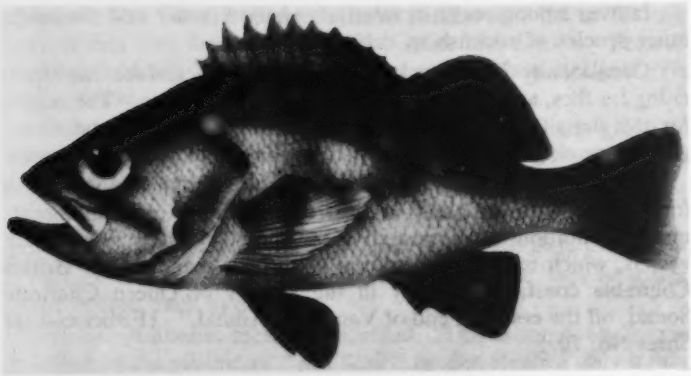
Quick Check.—Over-all red coloration, cheek spines with 2 and 3 points.

Notes.—The red snapper is perhaps the most highly prized of the rockfishes as a food fish, and as a result it is often seen in fish-shops.

Snappers live in relatively deep water, commonly from 30 to 150 fathoms. They are taken by hand-line or set-line and by trawls. When brought up from such depths, they are usually greatly distended by the tremendous expansion of the air bladder, which often forces part of the pharynx out through the mouth.

A female weighing 19½ pounds is reported to have contained about 2,700,000 eggs (Clemens and Wilby).

Small, bright-coloured rockfish seen by divers in schools along rocky shores are probably the young of another common species, the orange rockfish (*Sebastodes pinniger*).



Black Rockfish ***Sebastodes melanops* (Girard)**

melanops=dark coloured.

Description.—A bass-like fish. Head stout; mouth large with lower jaw only slightly projecting. Three spines on cheek-bone, the upper smallest; 2 small spines on gill cover. First part of dorsal fin with 13 spines and separated from second part by moderate notch. Anal fin with 3 spines and 7 to 9 rays. Ventral fins with 1 spine and 5 rays, placed below pectorals. Scales medium, in 60 to 70 rows.

Colour: Dark brown to black on back, paler on the sides and creamy on the belly. " Dark streak from eye across cheek, dark streak on maxillary; usually black spot on posterior of spinous portion of dorsal fin (conspicuous in young); black on all fins; sometimes carmine red on mandible and all fins except dorsal; white on peritoneum." (Clemens and Wilby.)

Size: Length to 20 inches.

Range: North-western Alaska to northern California.

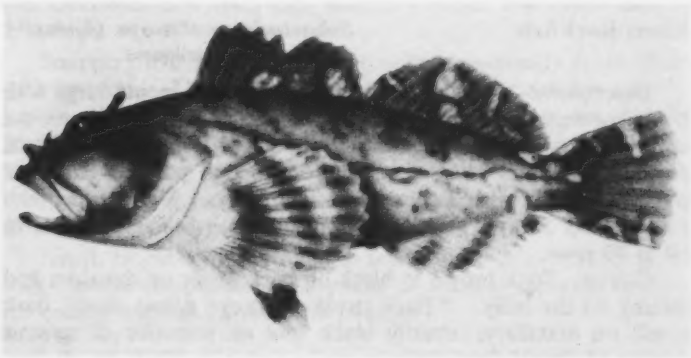
Quick Check.—Bass shape, 13 spines in first part of dorsal fin, dark colour, white peritoneum.

Notes.—The black rockfish is frequently caught on sport tackle using herring, a spoon, piece of rag, or artificial fly as a lure. Anglers often call this fish " blackbass."

It lives among rocks in relatively shallow water and resembles other species of rockfish in habits.

Occasionally black rockfish "flip" at the surface like trout rising for flies, and they are readily caught at this time. The reason for this mass activity is not known; the mood seems to be contagious because great numbers of fish may take part over a wide area.

The rockfishes in general have not been fully exploited as a food fish in British Columbia apparently because of unfavourable market conditions. "Almost all of the annual catch by Washington vessels, which exceeds ten million pounds, is made off the British Columbia coast, particularly in the vicinity of Queen Charlotte Sound, off the northern end of Vancouver Island." (Fisheries Fact Sheet No. 70.)



Cabezon
Giant Marbled Sculpin

***Scorpænichthys marmoratus* (Ayres)**
Scorpæn/ichthys = scorpion fish.
marmoratus = marbled.

Description.—A thick-set fish with elongate body. Head large with large mouth. A sharp spine near each nostril. Three spines on cheek, the lower one shortest. A single fleshy flap (cirrus) projecting forward from tip of snout, a plume-like cirrus behind each eye, and a short cirrus at angle of jaw. First portion of dorsal fin separated from second portion by a deep notch. First portion

of dorsal with 8 to 12 spines; second portion with 15 to 18 rays. Ventral fins well forward and with 1 spine and 5 rays. Pectoral fin large and fan-like. Lateral line decurved then straight. No scales visible.

Colour: Brown to dark green lightening to light green or whitish on the belly. Mottled with light blotches, each edged with dark brown or green. Very variable.

Size: Length to 30 inches and weight to 25 pounds.

Range: Northern British Columbia to Central Baja California.

Quick Check.—Large size, mottled appearance, lack of scales, cirrus behind each eye.

Notes.—Cabezon means big headed. This is one of the largest members of the sculpin or " bullhead " family, rivalled only by the great sculpin (*Myoxocephalus polyacanthocephalus*), which may also be 30 inches long, or by the red Irish lord, which may be 20 inches. None of the other local representatives exceeds 12 inches in length and most are under 5 inches.

The cabezon is usually taken around kelp-beds in moderately deep water. It feeds upon crabs, shrimps, molluscs (including abalones, limpets, and chitons), and other fishes. The eggs are laid in great numbers and in large masses attached to rocks in January, February, or March. The roe is said to be poisonous. Pillsbury (1957) observed that egg masses of this fish were not taken by birds or other predators though occasionally exposed to full view at low tide.

The larvæ drift in the plankton for several weeks. When they are about 1½ inches in length, they move into shallow water and take up an existence on the bottom. (O'Connell, 1933.)

Anglers frequently take this sculpin when fishing along rocky shores. The flesh is generally scorned as food, although it is perfectly edible and compares well with other market fishes.

The cabezon and other large sculpins are a favourite quarry of skindivers because they are relatively easy to approach and yet are not too easy to find.

Red Irish Lord ***Hemilepidotus hemilepidotus*** **(Tilesius)**
Hemi/lepidotus = half scaled.

Description.—A thick-set fish with elongate body. Head large with a large mouth. Large sharp spine near each nostril. Four spines on cheek, the upper two long and sharp, the lower two short and blunt. Four short spines on gill cover. A cirrus on the snout, near the nostril, behind the eye, on the top of the head, on the edge of the gill cover, and at the corner of the jaw on each side. First portion of dorsal fin separated from the second by a shallow notch. First portion of dorsal with 10 to 12 spines and a notch. Anal fin with 13 to 16 rays. Ventral fin well forward, with 1 spine and 4 rays. Pectoral fin large and fan-like. Lateral line starts high, curves down, then straight. Hair-like cirri on first portion of lateral line. A band of prickly scales along the base of the dorsal fin; 59 to 69 along the lateral line; and in short rows below the lateral line.

Colour: "Dull to brilliant red on dorsal surface, more or less mottled, barred with brownish red; pale red to grayish green on ventral surface, profusely covered with rusty to black spots." (Clemens and Wilby.)

Size: Length to 20 inches.

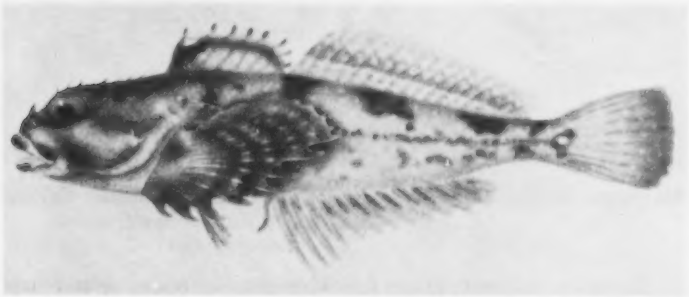
Range: North-western Alaska (Kodiak Islands and Bering Sea) to northern California.

Quick Check.—Reddish colour, shallow notch in the dorsal fin, scales in a band below the base of the dorsal fin.

Notes.—The red Irish lord is one of our more highly coloured "bullheads." Despite the bright colours and probably as a result of the contrasting pattern, this fish is hard to see in its usual environment along the rocky shoreline.

Possibly because it depends largely on camouflage for protection, it is remarkably tolerant toward a skindiver, even allowing itself to be picked up in the hand without showing alarm.

It feeds upon crabs, shrimps, barnacles, mussels, and probably small fishes. The eggs are laid in pink masses in March, often in the intertidal zone.



Tidepool Sculpin ***Oligocottus maculosus* Girard**

Oligo/cottus = small cottid.
maculosus = spotted.

Description.—A small typical "bullhead." Head conical, mouth small. A blunt spine near each nostril. One branched spine on cheek. First portion of dorsal fin separated from second portion by a deep notch. First portion of dorsal fin with 8 or 9 spines. Anal fin with 12 to 14 rays. Pectoral fins fan-like. Lateral line decurved then straight. No scales.

Colour: Variable; greenish, brown, or reddish on back, paling to bluish or greenish cream on belly. Five dark saddles across back. A white spot at base of tail fin. A small orange spot margined with black on front part of dorsal fin in male.

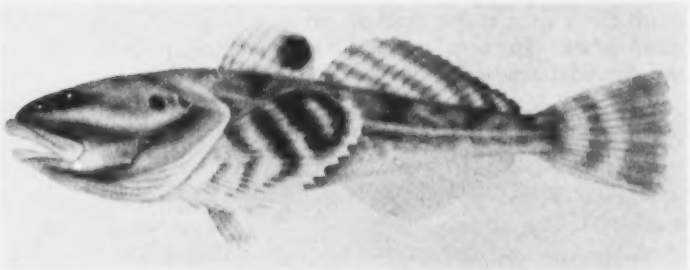
Size: Length to 3½ inches.

Range: North-western Alaska to northern California.

Quick Check.—The small size, branched cheek spine, and spot at base of tail fin.

Notes.—The tidepool sculpin is one of the commonest of the sculpins along the rocky coast in shallow water. Chances are that any small sculpin seen in a tide pool is of this species.

The eggs are pale greenish-blue and are deposited on a rock.



Staghorn Sculpin ***Leptocottus armatus* Girard**

Lepto/cottus = slender cottid.
armatus = armed.

Description.—A thick-set fish with elongate body. Head large and broad with a large mouth. Three spines on cheek, the upper one branched. First portion of dorsal fin completely separated from second portion by a V-notch. Six to eight spines in first portion. Anal fin with 15 to 20 rays. Ventral fins well forward and with 1 spine and 4 rays. Pectoral fin large and fan-like, extending well behind anus. Lateral line slightly curved. No scales.

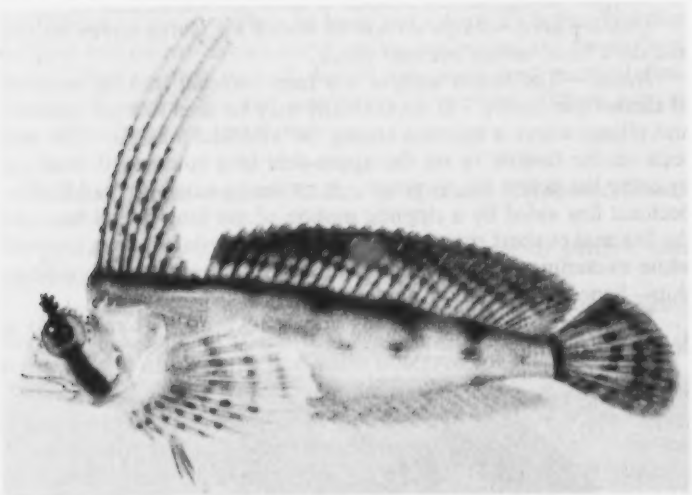
Colour: "Grayish olive to green with some yellow on dorsal surface: orange yellow to white on ventral surface; creamy yellow with green or black bars on all fins except pelvic (ventral) and anal; orange on margin with large black spot on posterior portion of spinous dorsal fin." (Clemens and Wilby.)

Size: Length to 12 inches.

Range: North-western Alaska to southern California.

Quick Check.—Broad head with branched spine on cheek, black spot on first portion of dorsal fin, lack of scales.

Notes.—The staghorn sculpin is common in relatively shallow water along the shoreline and occasionally is trapped in tide pools. It feeds upon a variety of small animals including fishes, and may be readily taken on a baited hook. When removed from the water or otherwise alarmed, it erects the cheek spines by expanding the gill covers in a threatening manner. It is taken to some extent by fish-eating birds.



Sailfin Sculpin ***Nautichthys oculofasciatus* (Girard)**

Naut/ichthys=sailor, fish.
oculo/fasciatus=eye, banded.

Description.—A bizzarre-looking fish with a humped back and sluggish habits. Head small with large eye and moderately large mouth. Two short, sharp spines on cheek. Several cirri on head; the most conspicuous are plume-like and attached to eyeball. First portion of dorsal fin very high with 8 or 9 spines, the first 5 longest; separated from second portion of fin by deep notch. Second portion very long. Tail rounded but with lower half longer than upper. Anal fin long with 18 to 20 rays. Ventrals well forward with 1

spine and 3 rays. Pectoral fin broad and fan-like reaching to beginning of anal. Lateral line curving downward then straight.

Colour: Brownish-grey on back lightening to grey then cream on sides and belly. A conspicuous black bar from the large cirrus diagonally through the eye and over the cheek. Five dark saddles over the body. Greenish bars on dorsal fins.

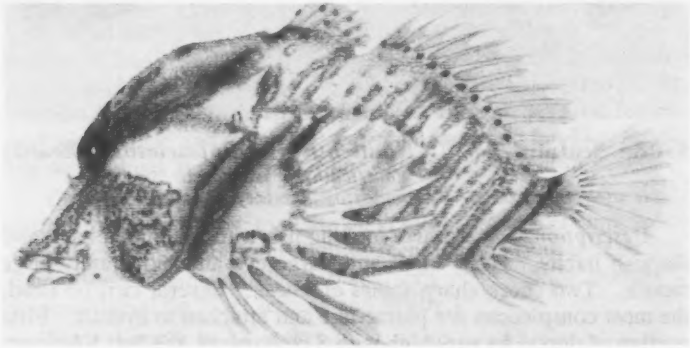
Size: Length to 8 inches.

Range: South-eastern Alaska to northern California.

Quick Check.—High section of dorsal fin; large cirrus on eye and dark band across eye and cheek.

Notes.—The sailfin sculpin is a most unusual looking member of the sculpin family. It occasionally may be seen around wharves and pilings where it browses among the attached mussels. The fish rests on the bottom or on the upper side of a submerged float-log by using the pelvic fins as props. It swims by using the paddle-like pectoral fins aided by a rippling motion of the long dorsal fin. As the fish makes short runs, the tall portion of the dorsal fin is lowered while swimming then raised at each stop like the mast of a sailing-ship—hence the common name.

Food consists of crustaceans and sea-worms. It ranges to a depth of 60 fathoms.



Grunt Sculpin ***Rhamphocottus richardsoni* Gunther**

Rampho/cottus=snout cottid.
richardsoni=after John Richardson, naturalist.

Description.—A bizarre, little, thick-set fish. Head large with high " forehead " and long snout ending in a small mouth. Eye small and deep-set. Two parts of dorsal fin well separated, the first with 7 or 8 spines, capable of being folded into a groove. Tail fin small and rounded. Anal fin close to tail and with 6 or 7 rays. Pectoral fin very large and fan-like, lower rays finger-like. Lateral line high, following contour of back. Scales represented by very small spiny plates.

Colour: Creamy yellow on back and sides with brown blotches on head and narrow brown bars running downward and forward on body. Red on first part of dorsal, tail, anal, and pectoral fins. Orange on ventral fins and lower rays of pectoral. Black spot at base of each ray in dorsal fin.

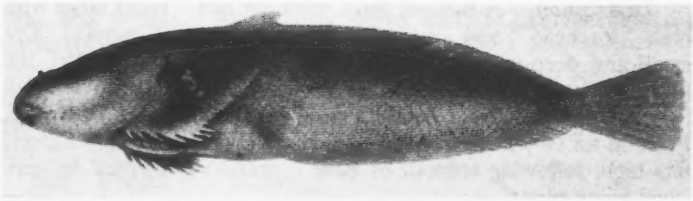
Size: Length up to 3 inches.

Range: North-western Alaska to northern California (Santa Monica Bay).

Quick Check.—The stubby shape, barred colour pattern, and finger-like rays of pectoral fin.

Notes.—Though the grunt sculpin is relatively common along the British Columbia coast, it is seldom seen by the layman. It never fails to attract attention when observed for the first time.

The grunt sculpin prefers shallow water along rocky shores, but it has also been taken on sandy bottom to a depth of 90 fathoms. In an aquarium it can be seen to creep over the bottom using the rays of the pectoral fin to push itself along. Sometimes it makes a grunting sound when removed from the water.



Tidepool Snailfish ***Liparis florœ* (Jordan and Starks)**

Liparis = sleek-skinned.
florœ = after Mrs. Flora Hartley Greene, of Stanford University.

Description.—A small smooth-skinned fish clinging to seaweed. Head flattened and bluntly rounded. Mouth small; nostrils double. Eye small. Skin smooth and loose. Dorsal fin long, with a shallow notch near the front end. Tail fin fan-shaped. Anal fin long. Pectoral fin broad with the lower rays ending in finger-like processes. A sucking-disk on the belly between the two pectoral fins.

Colour: Usually a uniform green or brown.

Size: Up to 5 inches; average about 2½ inches.

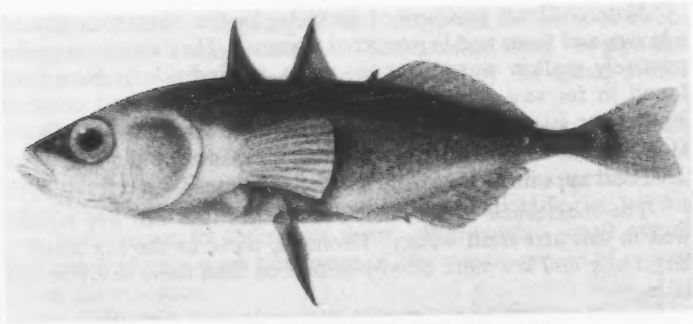
Range: Bering Sea to California.

Quick Check.—Small size, uniform green or brown colour, smooth skin, sucker on belly.

Notes.—Tidepool snailfish are most likely to be seen in beds of seaweed at low water. They cling to the flat fronds of green weed by means of the ventral sucker and so nearly match their background in colour they are usually not noticed until they loose their grip to wiggle to another resting-spot.

The suction pad is located well forward between the bases of the two pectoral fins. It is composed of the greatly modified ventral fins, which are combined to form an adhesive pad more or less oval in shape. The disk probably serves to anchor the fish against the action of surf and current.

The snailfishes, sometimes called " liparids," are represented by at least 13 species in British Columbia. Most are inhabitants of relatively deep water, but a few, including the tidepool snailfish, are found in the shallows.



Threespine Stickleback ***Gasterosteus aculeatus* Linnæus**

Gaster/osteus=belly bone, referring to the ventral shield.
aculeatus=with spines.

Description.—A small stiff-bodied fish with prominent spines. Head rather sharply pointed; mouth small, eye large. Dorsal fin preceded by three toothed spines, two long and one short. Tail fin small and used almost entirely as a rudder. Anal fin preceded by a short spine. Ventral fins each with one large spine, placed well forward beneath the space between first and second dorsal spine. All spines erectile and capable of being locked in position. Pectoral fin large and fan-shaped.

A series of bony plates along sides of body, variable in number and almost lacking in those living in fresh water. A triangular bony plate behind the ventral spines on the ventral surface, hence the scientific name.

Colour: Dark blue or almost black on back, silvery green or bluish on sides, cream on belly. Inside surface of ventral spines in male bright salmon red.

Size: Length to 4 inches.

Range: Circumpolar; on the Pacific Coast from Alaska to California.

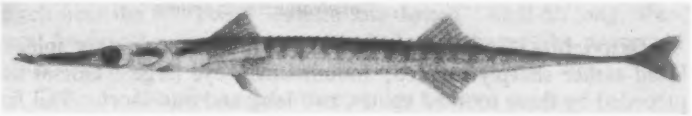
Quick Check.—The spines and bony plates are distinctive. So also is the method of swimming; i.e., holding the body stiffly, using the pectorals for propulsion and tail for steering.

Notes.—Great numbers of sticklebacks are often seen around wharves and floats and in protected lagoons. They appear to prefer relatively shallow water near the coast, yet individuals have been found in fur seal stomachs taken 20 miles off the west coast of Vancouver Island, and one was taken in a seine from 15 fathoms (Clemens and Wilby).

Food appears to be mostly small crustaceans.

The stickleback is one of the few fishes that can live equally well in salt and fresh water. However, those in the sea attain a larger size and are more heavily armoured than those in rivers and lakes.

In fresh water the male builds a saucer-shaped nest of plant material in which the eggs and young are assiduously guarded. Breeding habits in the sea appear to be unknown.



Tubesnout ***Aulorhynchus flavidus* Gill**

Aulo/rhynchus=pipe, snout.
flavidus=yellowish.

Description.—A long slender fish, tapering at each end. Body round in cross-section; small bony plates along mid-line of back, along sides, and along mid-ventral line behind anal fin. Head long, with drawn-out snout ending in a small mouth. A series of about 25 small spines on the back followed by a small rayed fin, set well back of mid-point. Tail fin small, but forked. Anal fin directly below rayed dorsal fin. Pelvic fins small, placed well forward. Pectoral fin large and broad.

Colour: Olive-green to yellowish-brown on the back. Mottled brown on the sides, fading to cream on the belly. Iridescent silver on cheeks and sides of body in front of pectoral fin. White peritoneum visible through sides. Body translucent.

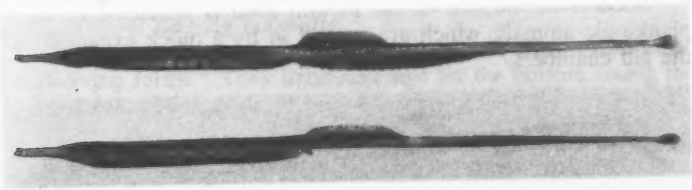
Size: About 6 inches.

Range: South-eastern Alaska to southern California.

Quick Check.—The long slender shape and the habit of swimming in schools around wharves. Distinguished from the pipe-fish by the rounded sides with minute plates and by the spines on the back.

Notes.—Tubesnouts sometimes attract attention around floats and wharf pilings, where they may be seen in schools, sometimes in large numbers. They swim mainly by means of the pectoral fins, which gives them a stiff appearance like that of sticklebacks, but the long body serves to distinguish them. With such a small mouth they can feed only upon tiny forms of life, mostly species of crustacea in the plankton.

In California spawning may take place at any season. The male builds a " nest " by cementing together fronds of seaweed to make a loose structure, and the eggs are laid in rings around parts of the seaweed above the nest. The male stands guard, as in the case of the stickleback. (Limbaugh, 1962.)



Pipefish ***Syngnathus griseolineatus*** **Ayres**

Syn/gnathus=together, jaw.
griseo/lineatus=grey lined.

Description.—A long slender fish, tapering at both ends. Body in cross-section, 6-sided in front of vent, 4-sided behind vent; a series of broad bony plates along each side. Head long with a drawn-out snout ending in a small mouth. No spines on back. Tail fin very small, fan-shaped. Anal fin very small in female, immediately behind vent; absent in male. Pelvic fins absent in both sexes. Pectoral fin small.

A brood pouch in the male, behind vent, formed by two folds of the body wall meeting along the mid-line.

Colour: Light or dark green to dark brown on back and extending down the sides. Paler on the belly.

Size: Up to 12 inches, slightly larger in females.

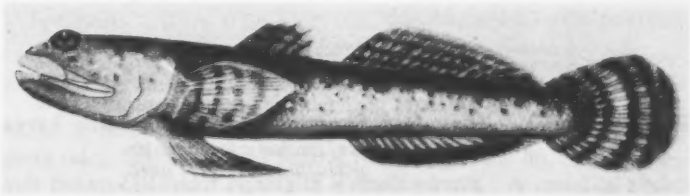
Range: South-eastern Alaska to southern California.

Quick Check.—The long body and slow swimming movements; the brood pouch in the male. Distinguished from the tubesnout by the angled sides with broad plates and centrally placed dorsal fin.

Notes.—The pipefish, like its near relative the seahorse, is remarkable for the fact that the male carries the eggs in a pouch. Even after hatching, the young remain in the pouch for a period of time until they are ready to swim off under their own power.

Pipefishes are usually found in relatively shallow water, such as in lagoons and sometimes among eelgrass, where they are difficult to see. Not only is the body shape like that of a frond of eelgrass, but the fishes float in the water like a piece of grass, sometimes even vertically. Swimming is accomplished largely by vibrating the dorsal fin, the pectorals and tail fin being used for steering and balancing.

Because of the size of the mouth, food is restricted to small planktonic animals, which are sucked in by a quick expansion of the gill chambers.



Arrow Goby ***Clevelandia ios* (Jordan and Gilbert)**

Clevelandia=after Daniel Cleveland, of San Diego, Calif.

ios=arrow.

Description.—A small slender fish. Head long with a large mouth reaching well behind the eye. Eye small and placed high on the head. Two dorsal fins, the first short with 4 or 5 spines, the second long with 15 to 17 rays. Tail broad with a rounded outline. Anal long. Ventrals well forward, below the pectorals and joined together to form a flaring cone used as a body prop.

Colour: Grey or greenish with many fine black and orange spots; fins with irregular bars. A black band on anal fin in males.

Size: Length to 2½ inches.

Range: Gulf of Georgia to southern California.

Quick Check.—Small size, slender body, big mouth, prop-like ventral fins.

Notes.—Swarms of small arrow gobies may be seen occasionally in shallow tide pools over sand or mud flats. Adults are most often found in burrows of mud shrimp (*Upogebia*) and other mud dwellers, where they apparently live as commensals. In such habitats they are apparently able to tolerate wide ranges in amounts of dissolved oxygen and other conditions found in stagnant water. This is borne out by the fact that we have maintained individual gobies in good health in small containers of sea water for periods exceeding two years without changing the water. In fact they are to be recommended to the aquarist interested in keeping marine fishes without running sea water.

In captivity arrow gobies readily take small worms and other small living forms. They habitually rest on the bottom, using the tail and ventral fins as props.

Wolf-eel ***Anarrhichthys ocellatus* Ayres**

Anarrh/ichthys=climber (an old erroneous name); fish.
ocellatus=spotted.

Description.—A long, slender eel-like fish. Head round. Mouth large with thick lips and prominent strong teeth, those near the front of the jaws conical, others molar-like. Eye small. Dorsal fin long, extending from back of head to end of body. No ventral fins. Scales very small and imbedded in the skin.

Colour: Dark grey to dark green (young individuals may be orange); many round black spots of differing size over body and back fin, each surrounded by a light area.

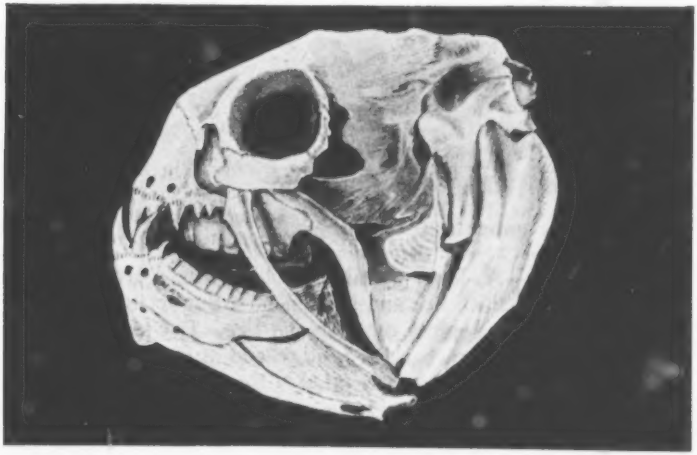
Size: Length to 8 feet; most adults are about 6 feet.

Range: South-eastern Alaska to southern California.

Quick Check.—Eel-like form, round head, prominent teeth, black eye-like spots.

Notes.—The wolf-eel is perhaps our most evil-looking fish and never fails to make an impression when seen for the first time. It is taken fairly frequently in traps, bottom trawls, and on hand-lines, and lately by spear-gun in the hands of skindivers. Trawlers state that wolf-eels are most often taken on bouldery bottoms, along with lingcod, and many may be taken in one haul.

Skindivers occasionally see a wolf-eel partly concealed under a rock with only the head showing or resting on the bottom in a kelp-bed. The wolf-eel is not known to make an unprovoked attack, but divers believe it will attack when cornered and especially if wounded. In any event it is wise to keep clear of the head end when a wolf-eel is still alive. Mr. G. R. Grosmith, a commercial fisherman of Victoria, bears scars of a wolf-eel bite on the ankle. The teeth penetrated hip-waders and broke the skin on both sides of the ankle joint.



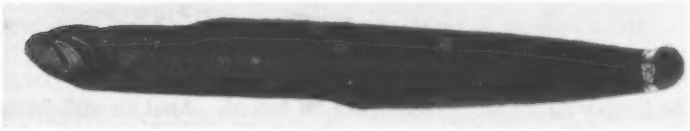
Skull of wolf-eel.

An adult wolf-eel light salmon-orange in over-all colour, instead of grey or dark green, was taken off Ucluelet on August 29, 1959, by G. R. Grosmith.

Food of the wolf-eel consists largely of molluscs, crustaceans, sea-urchins, and other hard-shelled creatures, as well as fish.

Swan (1870) reports the following:—

"A fish of the *Anarrhichthys* tribe is frequently killed during the summer months at low tide among the rocks. This is called the 'doctor fish' by the Indians (Mukah), and is never eaten except by some medicine-man who wishes to increase his skill in pharmacy."



Black Prickleback
Black Blenny

***Epigeichthys atropurpureus* (Kittlitz)**
Epige/ichthys=on land, fish.
atro/purpureus=dark purple.

Description.—A small eel-like fish. Head small and pointed, with oblique mouth. Dorsal fin long, running into tail fin. Tail fin rounded and joined to long anal fin. Ventral fins absent. Pectoral fin very small. Four lateral lines with many vertical branches. Scales small, smooth.

Colour: Reddish-brown to black; 3 prominent dark bands running back from eye, each with a light margin. A conspicuous white bar across the base of the tail.

Size: Length to 12 inches, usually 7 to 8 inches.

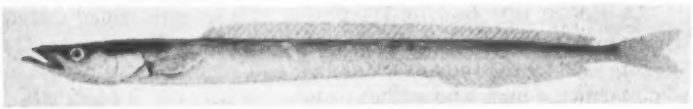
Range: South-eastern Alaska to southern California.

Quick Check.—Dark colour, 3 light-margined bands behind the eye, white bar across base of tail.

Notes.—The black prickleback is one of several kinds commonly found beneath rocks in the intertidal zone. These fishes seem to be able to remain out of water in cool, moist cavities for

a considerable period, at least between tides. They are often mistakenly called eels.

Pricklebacks feed upon a variety of small animals, and some eat algæ. In turn they are consumed by predatory fishes and birds, particularly the guillemot.



Sandlance ***Ammodytes hexapterus* Pallas**

Ammo/dytes=sand, diver.
hexa/pterus=six, fins.

Description.—A long, slender silvery fish. Head long and pointed. Mouth long with lower jaw projecting. From 130 to 150 slanting wrinkles in skin of side. Scales extremely small. Dorsal fin long, with 54 to 59 rays. Tail fin forked. Anal fin with 24 to 30 rays. No ventral fins.

Colour: Bluish-green on back; silvery on sides and belly.

Size: Length to 8 inches.

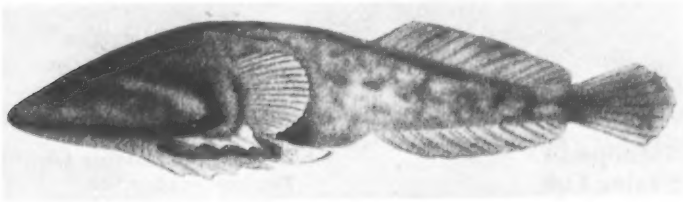
Range: North-western Alaska to southern California.

Quick Check.—Elongate silvery body, oblique skin folds, and lack of ventral fins.

Notes.—The sandlance, sometimes called "needlefish," is exceedingly abundant along the British Columbia coast. Large schools of young may be seen in shallow water, particularly in the spring and summer, and swarms of immature fish are often seen around floating wharves. Adults have been observed as far off shore as the Goose Island banks, 20 miles west of Goose Island in Queen Charlotte Sound.

Sandlance may bury themselves in sand with only the snout or head exposed for breathing. In such a habitat they are relatively safe from predators. Occasionally the sand in which they are buried is exposed at low tide, in which case the fish cover themselves completely. If the period of exposure is prolonged and if the day is sunny, fish periodically wriggle out of the sand and become of great interest to gulls and other fish-eaters.

The sandlance is a plankton feeder and in turn provides food for many other animals. At certain times of the year it is taken in great numbers by gulls, terns, murres, murrelets, guillemots, puffins, cormorants, and other fish-eating birds and is an important food item for coho, spring salmon, rockfish, lingcod, and other fishes. It is also used by fur seal, porpoise, and probably baleen whales such as the sharp-nosed finner whale. It is thus an extremely important link in the food chain in inshore waters.



Clingfish ***Gobiesox mæandricus* (Girard)**

Gobi/esox = goby, pike.
mæandricus = wandering (referring to the streaks).

Description.—A sculpin-like fish with a broad head and flattened body. Dorsal fin with 13 to 16 rays, set far back near the tail. Tail fin rounded. Anal fin with 12 to 14 rays and below the dorsal. Pelvic fins broad and united to form front edge of a large sucker on the belly. (The rear edge of the sucker is formed by a fold of skin.) Pectoral fins short but broad. No scales or lateral line.

Colour: Light olive-brown to reddish; brownish-orange reticulations and sometimes with black streaks or speckles; a pale brown bar between the eyes and obliquely across each cheek.

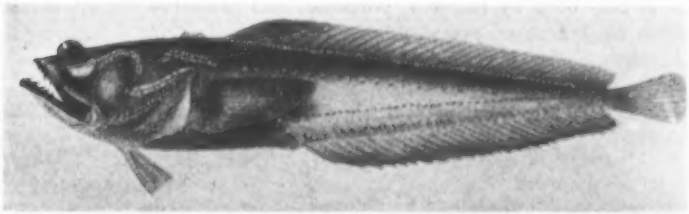
Size: Up to 6 inches but average around 3½ inches.

Range: South-eastern Alaska to southern California.

Quick Check.—The flattened shape, the dorsal fin set far back, and the large sucker on the belly.

Notes.—Clingfish are almost sure to be found on every rocky or bouldery beach. A favourite place at low tide is on the underside of boulders, where individuals may be found securely attached

by means of the sucking-disk. It is usually necessary to slide the fish along to an angled edge or to an uneven surface in order to loosen its hold if you wish to pick the specimen up. Food is said to be small crustaceans and molluscs.



Midshipman
Singing Fish

***Porichthys notatus* Girard**
Por/ichthys = pore, fish.
notatus = spotted or noted.

Description.—A sculpin-like fish with a broad head and long body. Eyes protuberant, on top of head. Mouth large, lower jaw projecting. Teeth sharp, curved. One sharp spine on each cheek, covered by skin. First portion of dorsal fin small, with 2 spines, in groove. Second portion long, with 33 to 37 rays. Tail fin rounded. Anal fin long with 29 to 34 rays. Ventral fins well forward under the head, with 1 spine and 2 branched rays. Pectoral fins broad. No scales. Many photophores (round shiny spots) in rows on head and body. Four lateral lines. Cirri in pairs along lateral lines and along rows of pores on head.

Colour: Olive-brown to dark blue on back; silvery grey on sides and golden yellow on belly. White patch below eye bordered with black below. Dark margins on dorsal and anal fins.

Size: Length to 15 inches but average about 9 or 10 inches.

Range: South-eastern Alaska to southern California.

Quick Check.—Flat head with protruding eyes; rows of photophores or " buttons " and golden-yellow belly.

Notes.—The midshipman is most likely to be found under rock slabs or boulders near the lowest tide level in late spring and early summer. The female lays her eggs on the underside of a rock, to

which each is attached by a short stalk. The eggs are yellow to pale pink in colour and about the size of a large pea. Even after hatching, the young remain attached for some weeks until the yolk is absorbed, after which they become free swimming. Up until this time the male remains in attendance.

When disturbed the male may make a grunting or humming sound, from which habit it gets the name singing fish. The sound is produced by vibrations in the swim bladder, and it has a ventriloquial quality, making it difficult to locate the " singer."

The rows of photophores have a fancied resemblance to brass buttons, hence the common name " midshipman " for this fish.

During most of the year, midshipmen are found on mud bottom in relatively deep water, 30 to 40 fathoms, where they may be taken by otter trawl. Breeding individuals move into the intertidal zone in the spring.

The photophores are luminescent organs which may be turned on or off at will. They probably serve for recognition, particularly during courtship.

GLOSSARY

Blueback—a coho salmon entering its third and final year of life.

Caudal—pertaining to the tail.

Cirrus (pl. *cirri*)—a fleshy filament or extension of the skin.

Commensal—living in close association, usually sharing food. One partner usually benefits without harming the other.

Copepod—a small crustacean. Some species exist in great numbers in the sea, providing an important source of food for fishes and other animals.

Ctenoid—a scale having a prickly or comb-like margin.

Dorsal—pertaining to the back or upper surface.

Euphausid—a small shrimp-like crustacean that sometimes occurs in immense numbers in the open sea and is the principal food of many fishes, whales, and birds.

Grilse—any young stage of salmon or trout. Most "grilse" taken in salt water are coho salmon in their second year of life. For purposes of fishery regulation a grilse is a "salmon of three pounds in weight or less undressed."

Invertebrate—an animal with no backbone.

Jack—usually applied to a male fish maturing a year or more earlier than the normal.

Lateral line—a canal along the side of the body with a series of pore-like openings sensitive to water vibrations and pressure changes.

Mandible—the main bone forming the lower jaw.

Mud shrimp—a shrimp-like crustacean commonly found in mud burrows (*Upogebia* or *Callianassa*).

Neap tide—a medium high tide occurring when the moon is in the first quarter and again in the last quarter.

Peduncle—the narrow part of body just in front of the tail fin.

Peritoneum—the thin membrane lining the entire body cavity.

Photophore—a light-producing organ.

Pore—a small opening, such as that leading to a gland or to the lateral-line organ.

Ray (of a fin)—the flexible support to the fin membranes.

Sea-trout—probably cutthroat or young steelhead in salt water.

Selachian—a member of the shark and ray group of fishes.

Spine—the unsegmented and usually stiff support of the fin membrane.

Spring tide—the high tide of the series occurring shortly after the new and the full moon.

REFERENCES

CLEMENS, W. A., and WILBY, G. V.

1961. Fishes of the Pacific Coast of Canada. Bull. 68, Fish. Res. Bd. Can., pp. 1–443.

COMMITTEE ON NAMES OF FISHES.

1960. A List of Common and Scientific Names of Fishes from the United States and Canada. Amer. Fish. Soc. Spec. Pub. No. 2, pp. 1–102.

HITZ, CHARLES R., and DELACEY, ALAN C.

1959. Reproduction and Fecundity of Rockfishes (*Sebastodes*). Contr. No. 77, College of Fisheries, University of Washington.

LIMBAUGH, CONRAD.

1962. Life History and Ecological Notes on the Tubenose, *Aulorhynchus flavidus*, a Hemibranch Fish of Western North America. Copeia, No. 3, pp. 549–555, 1962.

MCHUGH, J. L.

1939. The Eulachon. Fish. Res. Bd. Can. Prog. Rept. Pac., No. 40, pp. 17–22.

1940. Where does the eulachon spawn? Fish. Res. Bd. Can. Prog. Rept. Pac., No. 44, pp. 18–19.

NORMAN, J. R., and FRASER, F. C.

1949. Field Book of Giant Fishes. G. P. Putnam's Sons, New York.

O'CONNELL, CHARLES P.

1953. The Life History of the Cabezon, *Scorpænichthys marmoratus* (Ayres). Calif. Dept. Fish and Game, Fish. Bull., No. 93, pp. 1–76.

PIKE, GORDON.

1962. First Record of the Great White Shark (*Carcharodon carcharius*) from British Columbia. Jour. Fish. Res. Bd. Canada, Vol. 19, No. 2, p. 363.

PILLSBURY, R. W.

1957. Avoidance of Poisonous Eggs of the Marine Fish *Scorpænichthys marmoratus* by Predators. Copeia, No. 3, pp. 251–252.

SCHAEFER, MILNER B.
1936. Contribution to the Life History of the Surf Smelt (*Hypomesus pretiosus*) in Puget Sound. Wash. Div. Scientific Research, Biol. Rept. No. 35 B, pp. 1–45.

SUNDE, L. A., and LINDSEY, C. C.
1958. Revised Key to the Rock Fishes (*Scorpænidæ*) of British Columbia. Univ. of B.C. Museum Contr. No. 1, pp. 1–6.

SWAN, JAMES G.
1870. Indians of Cape Flattery. Smithsonian Contr. to Knowledge, 220, pp. 1–108.

TARP, FRED HARALD.
1952. A Revision of the Family Embiotocidæ (the Surf-perches). Calif. Dept. Fish and Game, Fish. Bull., No. 88, pp. 1–99.

TESTER, ALBERT L.
1938. Herring, the Tide, and the Moon. Fish. Res. Bd. Can. Prog. Rept. Pac., No. 38, pp. 10–14

TULLY, JOHN P.
1953. Oceanography—Science of the Sea. Canadian Geographic Journal.

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